DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-229

TO 31R2-2FRR-161

F-1 #6

RADIO RECEIVING SETS

AN/FRR-36 AND AN/VRR-7

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

DECEMBER 1954

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Avoid bodily contact with high voltage, 115-volt, and 230-volt, alternating current input connections.

DO NOT TAKE CHANCES!

By order of the Secretaries of the Army and the Air Force:

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Corps	USA Elct PG	19–500 (AA–AE)
	USA Comm Agcy	

NG: State AG; units—same as Active Army.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1958

RADIO RECEIVING SETS AN/FRR-36 AND AN/VRR-7

TM 11-229
TO 31R2-2FRR-161
CHANGES No. 1

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *21 February 1958*

TM 11-229/TO 31R2-2FRR-161, 3 December 1954, is changed as follows:

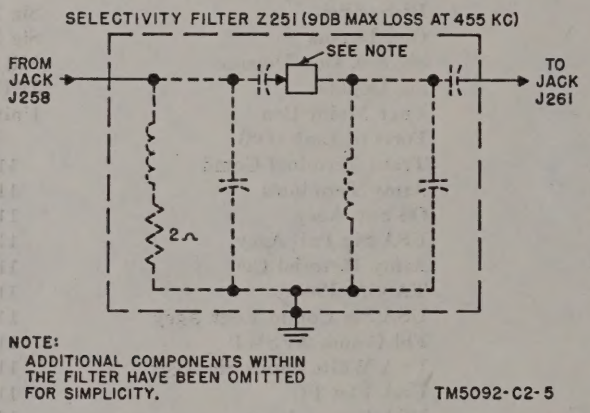
Page 3, paragraph 2.

b. (Superseded) DA Form 468 (Unsatisfactory Equipment Report) will be filled out and forwarded to Commanding Officer, Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AG 700-38.

Page 20, paragraph 25*a*.

(4) (Added) Drive a metal stake into the ground as close as possible to the operating position. Connect one end of a ground wire (No. 12 AWG or larger) to the stake. Run the other end of the wire through the louver in the rear cover and parallel to the power cord (fig. 17). Connect it to ground terminal 8 on TB 2401 (fig. 18).

Page 50, figure 33. Delete selectivity filter Z251 and substitute new selectivity filter Z251:



Selectivity filter Z251, part of figure 33.

[AG 413.44 (23 Jan 58)]

TECHNICAL MANUAL
No. 11–229
TECHNICAL ORDER
No. 31R2–2FRR–161

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *3 December 1954*

RADIO RECEIVING SETS AN/FRR–36 AND AN/VRR–7

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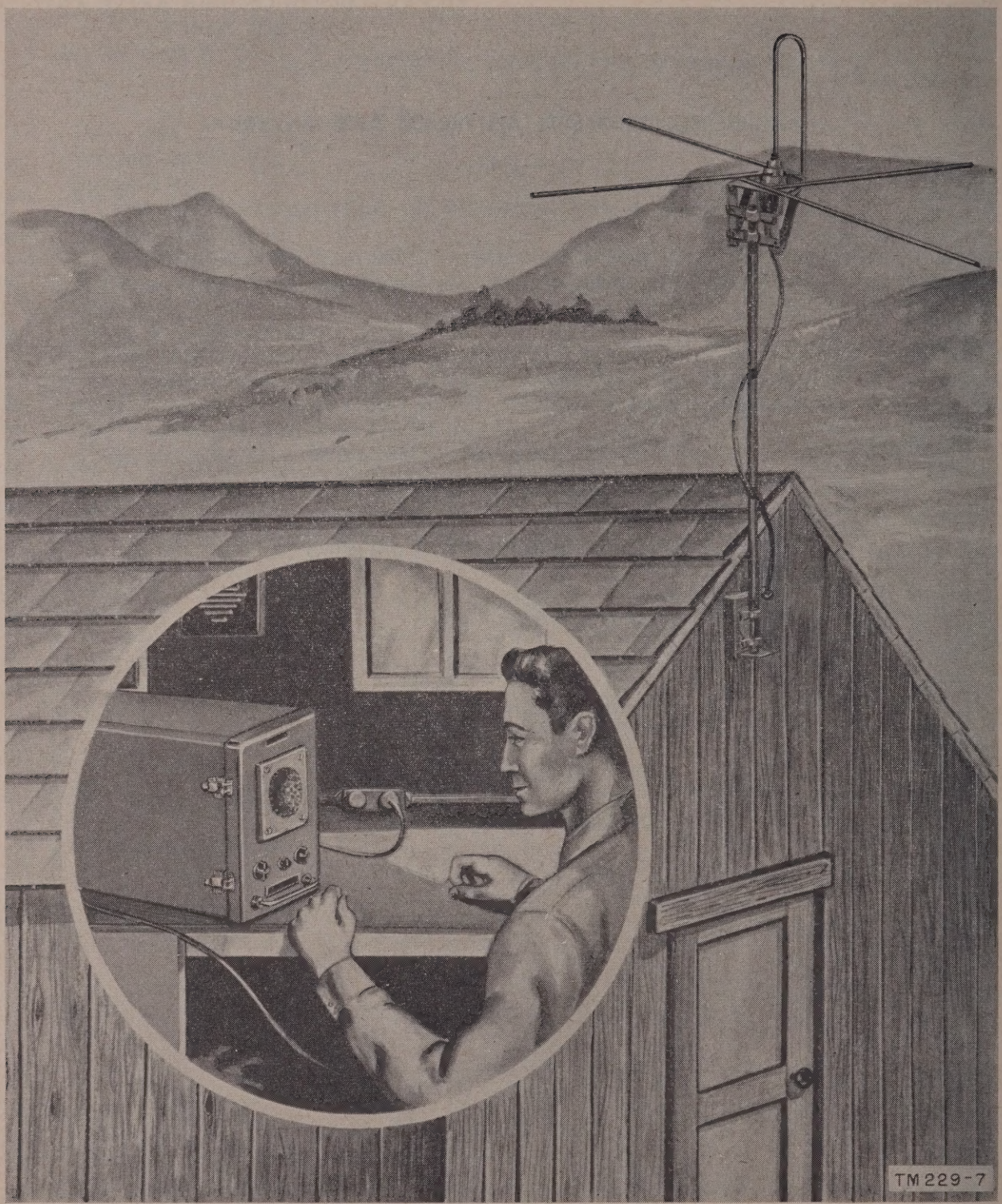


Figure 1. Radio receiving set AN/FRR–36 in use.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual provides the necessary information for the installation, operation, maintenance, and repair of Radio Receiving Sets AN/FRR–36, AN/VRR–7, AN/VRR–7X, and AN/VRR–7Y.

b. Official nomenclature followed by an asterisk (*) is used to indicate all models of the equipment item covered in this manual. Thus, Radio Receiving Set AN/VRR–7(*) represents Radio Receiving Sets AN/VRR–7, AN/VRR–7X, and AN/VRR–7Y.

c. The information in this manual is supplemented by TM 11–5092, Radio Receiver R–394/U and TM 11–5078, Power Supply PP–846/U. Power Supplies PP–867/U, PP–868/U, and PP–869/U are covered in TM 11–5079. There are frequent references to these books throughout this manual.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6 (Report of Damaged or Improper Shipment) will be filled out and forwarded as prescribed in SR 745–45–5 (Army), Navy Shipping Guide, Article 1850–4 (Navy), AFR 71–4A (Air Force).

b. DA Form 468 (Unsatisfactory Equipment Report) will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DA Form 11–238 (Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar)) will be prepared in accordance with instructions on the back of the form (fig. 25).

d. DA Form 11–239 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar)) will be prepared in accordance with instructions on the back of the form (fig. 26).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. The major components of Radio Receiving Set AN/FRR–36 are Radio Receiver R–394/U mounted in Electrical Equipment Cabinet CY–1150/U, with Power Supply PP–846/U located in the receiver. This radio receiving set is a complete receiving system, and the only external connections required are a connection between Antenna AT–438/GR and the receiver and a connection to a 115- or 230-volt alternating current (ac) power supply. The power supply is fitted into the receiver base assembly and the receiver plugs into the cabinet.

b. The major components of Radio Receiving Set AN/VRR–7(*) are Radio Receiver R–394/U and Electrical Equipment Cabinet CY–1223/G. The receiver is contained in the cabinet. The receiver contains either a 6-, 12-, or 24-volt direct-current (dc) vibrator-type power supply. The radio receiving sets are designated as follows:

(1) Radio Receiving Set AN/VRR–7Y consists of Radio Receiver R–394/U, Power Supply PP–869/U, and Electrical Equipment Cabinet CY–1223/G. This combination is used for 6-volt dc vehicular operation.

(2) Radio Receiving Set AN/VRR–7X consists of Radio Receiver R–394/U, Power Supply PP–868/U, and Electrical Equipment Cabinet CY–1223/G. This combination is used for 12-volt dc vehicular operation.

(3) Radio Receiving Set AN/VRR–7 consists of Radio Receiver R–394/U, Power

Supply PP–867/U, and Electrical Equipment Cabinet CY–1223/G. This combination is used for 6-volt dc vehicular operation.

c. Radio Receiving Set AN/VRR–7(*) is furnished with either Antenna AT–496/G (for metal-top vehicles) or a small coaxial type antenna (for vehicular bumper mounting). Both antennas are furnished in their respective installation kits.

d. Electrical Equipment Cabinets CY–1150/U and CY–1223/G have similar internal housing compartments.

e. Both Radio Receiving Sets (AN/FRR–36 and AN/VRR–7(*) are designed to receive frequency-modulated (fm) signals on a predetermined frequency or channel. The frequency range of either radio receiving set if from 152 to 174 megacycles (mc). They can be used to monitor communications between radio sets operating on the same frequency. They are useful in a repair depot as test setups for repairing and testing Radio Receiver R–394/U.

4. System Application
(fig. 2)

a. Radio Receving Sets AN/FRR–36 and AN/VRR–7(*) are designed for use in monitoring systems or as receiving sets for reception of transmissions from other fm radio sets operating on frequencies from 152 to 174 mc.

b. Figure 2 illustrates system application of Radio Receiving Sets AN/FRR–36 and AN/VRR–7(*).

5. Technical Characteristics of Radio Receiver R–394/U

Frequency range	152 to 174 mc.
Receiver type	Double-conversion, crystal-controlled, superheterodyne, fixed-frequency.
Crystal range (3d overtone in LOCAL OSC 152–174 MC plug-in unit).	24.033 to 27.7 mc (Crystal Unit CR–32/U).
Types of signals that can be received.	Fm (15-kc deviation).
Number of tubes	22.
Intermediate frequencies	7.8 mc and 455 kc.
Second hf crystal oscillator frequency.	7.345 mc (Crystal Unit CR–18/U).
Power supplies	PP–846/U (connected to a 115- or 230-volt source); or PP–867/U (connected to a 24-volt vehicular battery); or PP–868/U (connected to a 12-volt vehicular battery); or PP–869/U connected to a 6-volt vehicular battery).
Output impedance	8 ohms.
Power output	.5 watt at less than 10% distortion.
Audio frequency response	300 to 3,500 cps±1 db without de-emphasis, 6 db per octave±1 db with de-emphasis.
Special features	Squelch and muting circuits.
Antenna impedance	52 ohms.
Weight	17 lb.

6. Technical Characteristics of Power Supply PP–846/U

Power input	115 volts ac, 46 volt-amperes, 50 to 65 cps. or 230 volts ac, 46 volt-amperes, 50 to 65 cps.
Power for receiver filament and heater circuits:	
6.3-volt filaments	.45 amp.
6.3-volt crystal heater	.9 amp.
1.4-volt filament	1.25 amp.
Power for receiver plate, screen grid, and bias circuits:	
160 volts dc	15 ma.
155 volts dc	5 ma.
145 volts dc	50 ma.
—40 volts dc	.5 ma.
Dimensions	5 in. high by 6¼ in. wide by 7 1/16 in. long.
Weight	9½ lb.

7. Technical Characteristics of Power Supplies PP–869/U, PP–868/U, AND PP–867/U

Rated input power:	
PP–869/U	6 volts dc at 3.7 amp.
PP–868/U	12 volts dc at 2.0 amp.
PP–867/U	24 volts dc at 1.1 amp.
Power for receiver filament and heater circuits:	
PP–869/U	6.3 volts dc at .45 amp.
	6.3 volts dc at 1.0 amp.
	1.4 volts dc at 1.25 amp.
PP–868/U	6.3 volts ac at .45 amp.
	6.3 volts ac at 1.0 amp.
	1.4 volts dc at 1.25 amp.
PP–867/U	6.3 volts ac at .45 amp.
	24 volts dc at 250 ma.
	1.4 volts dc at 1.25 amp.

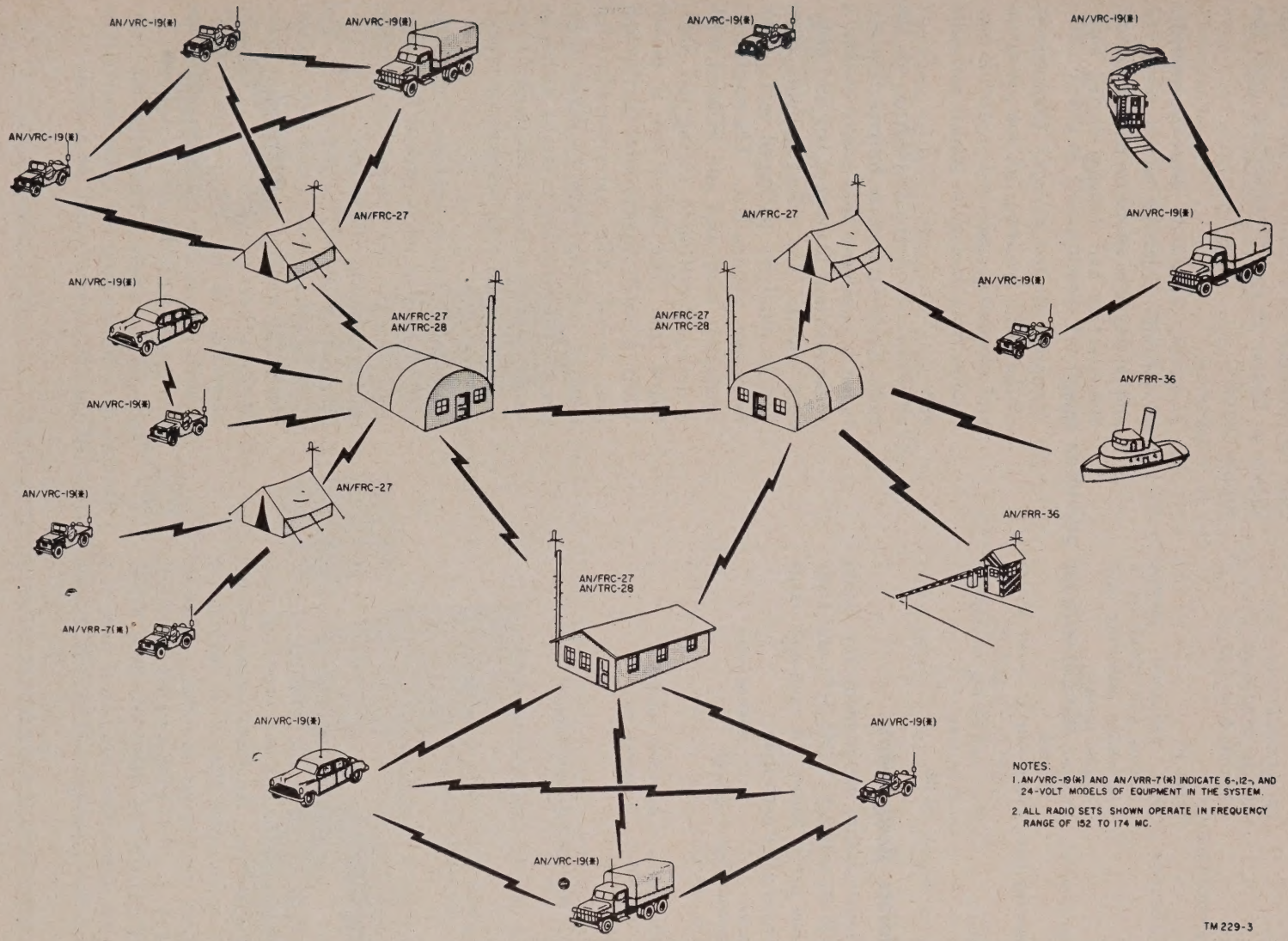


Figure 2. Typical system application.

Power for receiver plate, screen, and bias circuits:	
PP–869/U, PP–868/U, or PP–867/U.	155 volts dc at 15 ma. 150 volts dc at 5 ma. 140 volts dc at 50 ma. −40 volts dc at .5 ma.
Adaptability to service conditions:	
Altitude	10,000 ft.
Shock and vibration	Will withstand shocks, strains, and vibrations in a vehicle operating over rugged terrain.
Weather and climate	Fungiproofed and moisture-proofed.
Normal operating temperature.	From −40° C. (−40° F.) to +55° C. (+132° F).
Dimensions	5 in. high by 6¼ in. wide by 7 in. long.
Weight	10 lb.

8. Nomenclature Assignments

A list of nomenclature assignments for Radio Sets AN/FRR–36 and AN/VRR–7(*) and their components are given below. A common usage name is indicated after each item.

Nomenclature	*Common Name*
Electrical Equipment Cabinet CY–1150/U or CY–1223/G.	Cabinet
Power Supply PP–846/U	Ac power supply
Power Supply PP–867/U, PP–868/U, or PP–869/U or PP–869/U.	Dc power supply
Radio Receiving Set AN/FRR–36.	Ac receiving set
Radio Receiving Set AN/VRR–7(*).	Dc receiving set
Radio Receiving Sets AN/FRR–36 or AN/VRR–7(*).	Radio receiving set Receiver
Radio Receiver R–394/U	Receiver.

9. Packaging Data

a. General. Contents of all packages are stenciled directly on the box. A packing slip is stapled to the side of the box and protected with a waterproof envelope. An orange band painted around the box indicates that it is packed for export. Export packaging is labeled PACKAGED WITH A DEHYDRATING AGENT, DO NOT OPEN UNTIL READY FOR USE. An orange spot means that the box is part of a shipment; each box is designated by a label such as 1/3, 2/3, 3/3, etc. For example, box No. 1 of a shipment of three boxes is indicated 1/3. Items may be packaged in a manner other than that shown on figures 12 and 13 depending upon the supply channel.

b. Packaging.

(1) *Domestic, immediate use.* Components of the radio receiving set are preserved and packaged to afford protection against deterioration and damage during shipment.

(2) *Domestic, limited storage.* Components of the radio receiving set are preserved and adequately cushioned to provide protection from damage in transit and storage.

(3) *Military, oversea.* Packaging of the radio receiving set is as follows: The antenna is cushioned and placed within a water-resistant fiberboard box and properly sealed. The 5-foot antenna mast will be similarly packaged and placed in its own wooden box. The receiver is adequately cushioned and inclosed with a desiccant within a corrugated fiberboard box. The sealed box is placed within a water-vaporproofed barrier and heat sealed. The water-vaporproofed receiver, together with packaged spare parts and accessories, is placed within an outer water-resistant fiberboard box which is sealed with waterproof tape.

c. Packing.

(1) *Domestic shipment, immediate use.* The radio receiving set is packed in accordance with the best commercial practices within shipping containers.

(2) *Domestic shipment, limited storage.* The radio receiving set is packed within wood-cleated plywood or nailed wooden boxes.

(3) *Military oversea shipment.* The radio receiving set is packed within wood-cleated plywood or nailed wooden boxes reinforced with flat steel strapping.

d. Packing Data Chart. The following chart includes data for packing the radio receiving set (the cabinet and receiver) and the antenna:

Contents	Size (in.)	Weight (lb)	Volume (cu ft)
Receiver (in cabinet), bare	19½ x 7¾ x 10¾	40. 75	. 94
Receiver (in cabinet), packaged	24⅝ x 9⅞ x 12⅞	61. 5	1. 81
Box 1 of 2 (receiver in cabinet), packed	43¾ x 11⅞ x 15¼	88. 0	4. 50
Antenna, bare	29 x 12 x 5	49. 5	1. 00
Antenna, packaged	29⅝ x 12¼ x 5¼	66. 0	1. 10
Box 2 of 2 (packaged antenna), packed	36⅜ x 15¼ x 8¼	88. 0	2. 75

10. Table of Components for Radio Receiving Set AN/FRR–36

(fig. 3)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Electrical Equipment Cabinet CY–1150/U	1	10⅝	21¼	7½	1	14½
Radio Receiver R–394/U	1	8½	14½	5¾	. 42	17
Power Supply PP–846/U	1	5	6¼	7 1/16	. 13	9½
Cord CG–399A/U	1			100 ft		
Power cord	1			15 ft		
Antenna AT–438/GR	1	21	57¼	57¼	. 40	7½
Running spares kit	1	6⅜	6⅜	4¾	. 11	
TM 11–229	2	11	¼	8½	. 03	½
TM 11–5092	2	11	½	8½	. 06	½
TM 11–5078	2	11	¼	8½	. 03	½
Total					2. 18	50

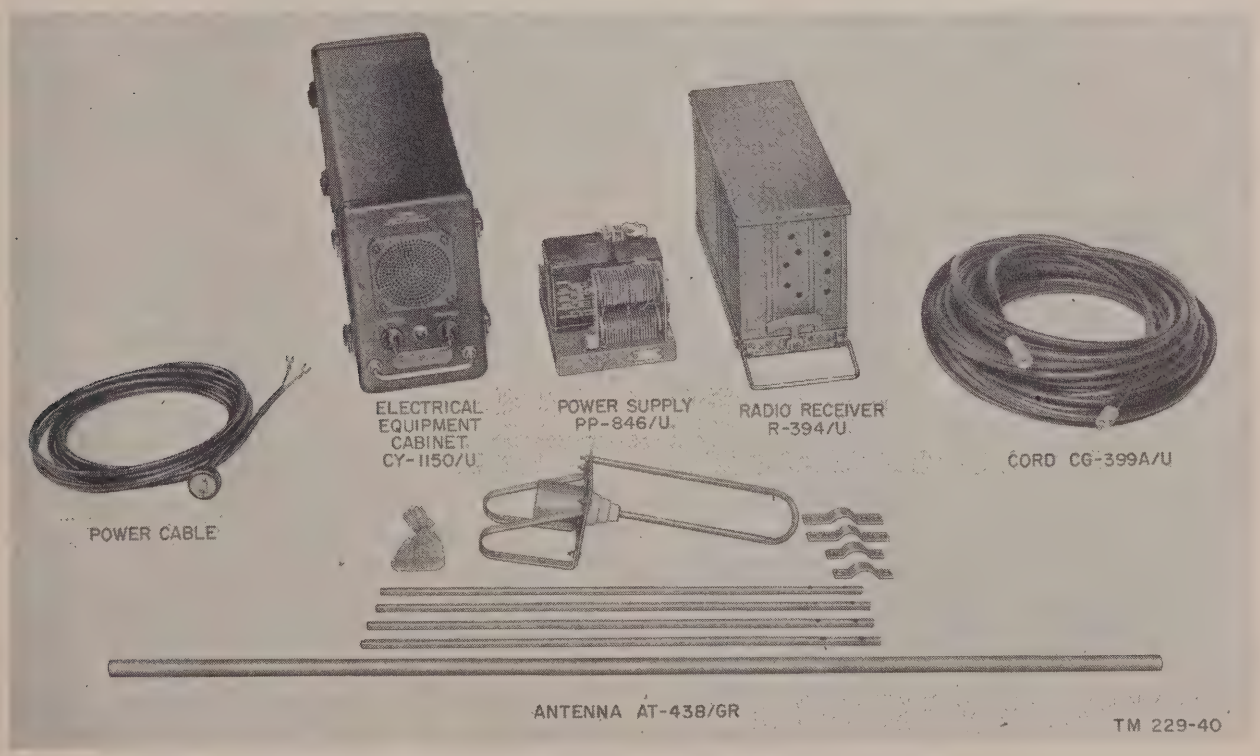


Figure 3. Components of radio receiving set AN/FRR–36.

11. Table of Components for Radio Receiving Set AN/VRR-7(*)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Electrical Equipment Cabinet CY–1223/G	1					
Radio Receiver R–394/U	1	8½	14½	5¾	.42	17
Power Supply PP–867/U, Power Supply PP–868/U, or Power Supply PP–869/U	1					
Antenna rf lead	1					
Power cord	1					
Running spares kit	1					
TM 11–229	2	11	¼	8½	.03	.5
TM 11–5092	2	11	½	8½	.06	.5
TM 11–5079	2	5⅞	⅛	9⅛	.004	.10

12. Description of Electrical Equipment Cabinet CY–1150/U

a. The cabinet (fig. 3) is an aluminum case painted with a green semigloss enamel. It has one compartment which is designed to contain Radio Receiver R–394/U. The front cover contains a loudspeaker, a VOLUME-OFF control, and a SQUELCH control and disable switch (fig. 24). The rear cover contains a coaxial connector (fig. 4) for connecting the antenna transmission line and an opening for admitting the power cable. Both front and rear covers are each fastened to the cabinet with four snap fasteners. When these covers are secured properly, the cabinet is moistureproof because of a rubber gasket between the cabinet and the front and rear covers. A handle (fig. 3) on the front of the cabinet makes it easier to handle.

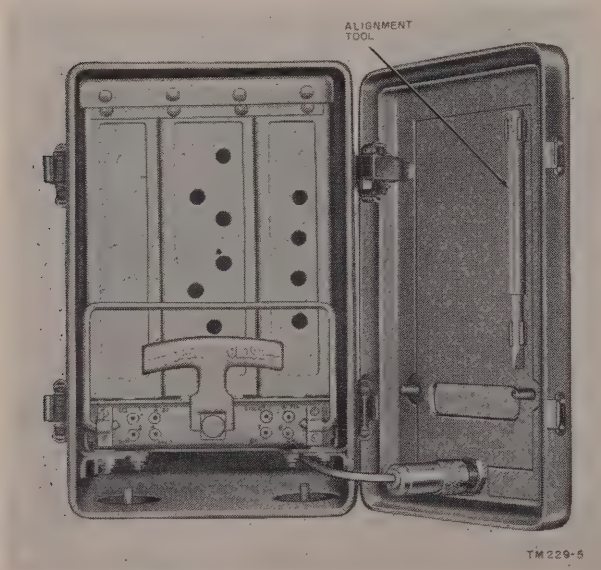


Figure 4. Radio receiving set AN/FRR–36, rear cover removed.

b. A connector inside the cabinet mates with the main receiver connector in Radio Receiver R–394/U. Corresponding connectors complete various circuits between the receiver, power supply, antenna, and the controls and loudspeaker in the cabinet.

c. When the receiver is fitted into the cabinet, two tracks and two holddown springs provide a firm mechanical seating. The lock-in rod on the receiver locks the receiver in the cabinet and thus prevents the receiver and cabinet connectors from becoming disengaged or damaged.

d. Radio Receiver R–394/U can be operated and tested with this ac cabinet provided that Power Supply PP–846/U is properly installed.

13. Description of Electrical Equipment Cabinet CY–1223/G

This cabinet (the CY–1223/G) is internally similar to Electrical Equipment Cabinet CY–1150/U described in paragraph 12. Power Supply PP–867/U, PP–868/U, or PP–869/U is used to power Radio Receiver R–394/U.

14. Description of Radio Receiver R–394/U

a. Radio Receiver R–394/U (fig. 5) is a 22-tube fm dual conversion superheterodyne receiver. It operates as a fixed crystal frequency receiver with a frequency range of 152 to 174 mc. The high frequency (hf) oscillators are crystal controlled to provide maximum stability. The receiver is connected to either Electrical Equipment Cabinet CY–1150/U or CY–1223/G by a single connector on the rear panel. No controls are provided on

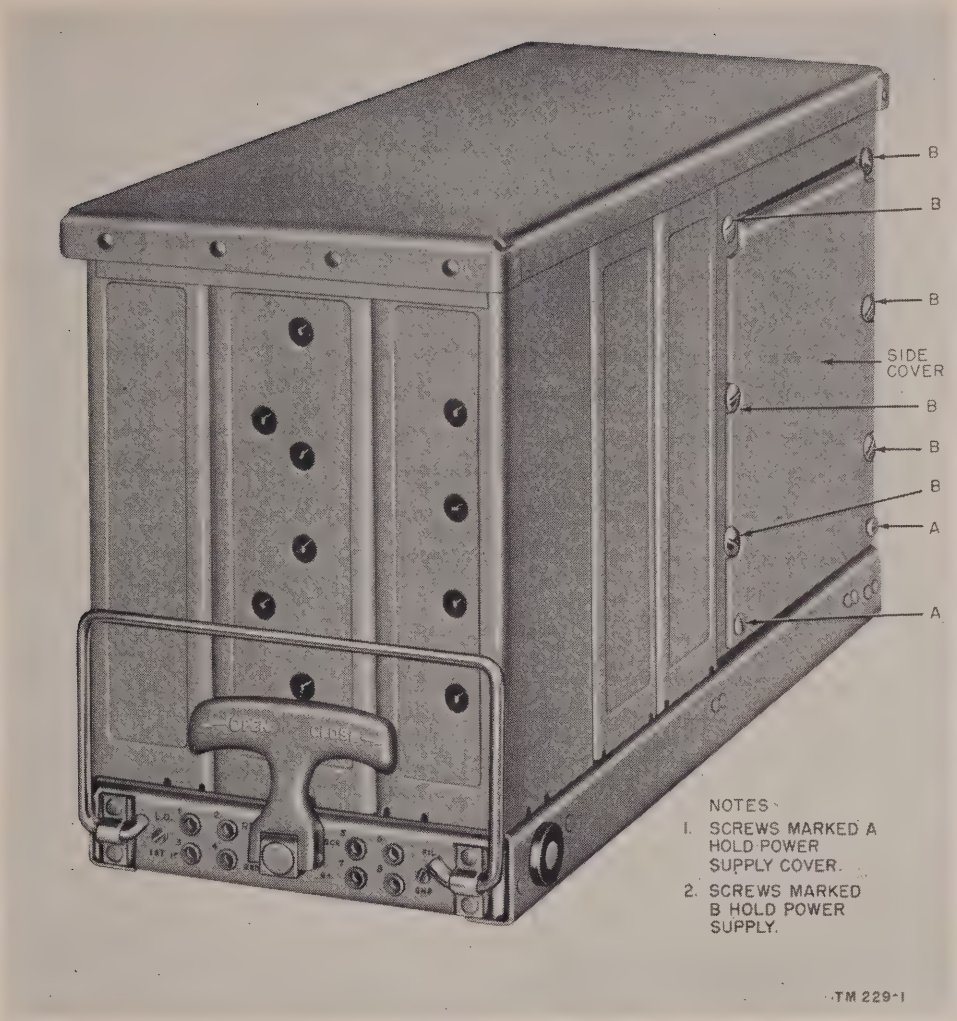


Figure 5. Radio receiver R–394/U.

the receiver panel. All adjustments are performed by means of controls on the front panel of the cabinet (fig. 24).

b. The receiver is made up of a main chassis or base assembly with plug-in subassemblies for the various stages (fig. 6). The base has interconnecting wiring and jacks to complete the signal and power distribution paths through the receiver. Each subassembly occupies a shielded compartment and is further shielded by a metal sleeve between the subassembly and compartment walls. Such construction permits rapid servicing and a minimum of stock parts for replacement.

c. The receiver can be made to operate at a frequency different from that initially set up. To accomplish this, it is necessary to change a crystal in the hf oscillator and realine all the stages preceding the first mixer (pars. 29 and 30). This operation is not to be attempted by the operator but must be performed by competent maintenance personnel.

d. One of the receiver compartments is designed to accommodate either an ac or dc power supply (a separate component). The power supply, which is plugged into the receiver, must be capable of operating at the input voltage for the radio receiving set in which it is installed. The receiver is designed to use Power Supply PP–846/U when operating as part of Radio Receiving Set AN/FRR–36, or the receiver may use either Power Supply PP–867/U, PP–868/U, or PP–869/U when operating as part of Radio Receiving Set AN/VRR–7(*). See paragraphs 15 and 16 for description of the ac and dc type power supplies.

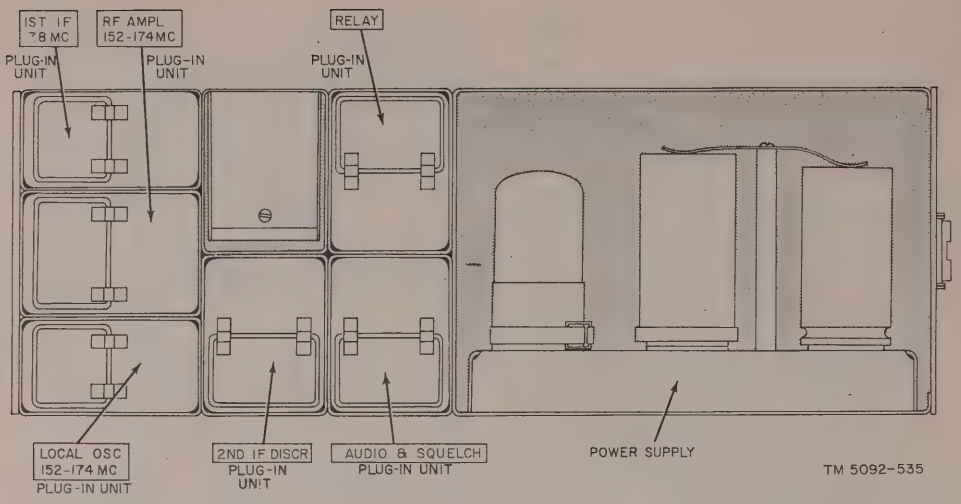

1ST IF 7.8 MC PLUG-IN UNIT
RF AMPL 152-174 MC PLUG-IN UNIT
RELAY PLUG-IN UNIT
LOCAL OSC 152-174 MC PLUG-IN UNIT
2ND IF DISCR PLUG-IN UNIT
AUDIO & SQUELCH PLUG-IN UNIT
POWER SUPPLY
TM 5092-535

Figure 6. Radio receiver R–394/U, top view, cover removed.

15. Description of Power Supply PP–846/U

Power Supply PP–846/U (fig. 7) is a supply designed to operate from a 115-volt or 230-volt ac power source. It consists of a chassis on which are mounted the various parts necessary to supply the voltages required by Radio Receiver R–394/U. A compartment is provided for the power supply in the receiver base. The power supply is fastened to the receiver base with six 10–32 screws (fig. 5). Input and output power connections between the power supply and receiver base are made by a multiple contact connector on the power supply which mates with another connector in the receiver base.

16. Description of Power Supplies PP–867/U, PP–868/U, and PP–869/U

a. General. All the dc power supplies are similar in appearance. Power Supply PP–867/U (fig. 8) is a vibrator-type power supply designed to operate from a 24-volt storage battery. It consists of a chassis on which are mounted the various components necessary for transforming, rectifying, filtering, and regulating the voltages required by the receiver. It is built to fit into a compartment in Radio Receiver R–394/U. The chassis is fastened in place by six 10–32 bolts. Power Sup-

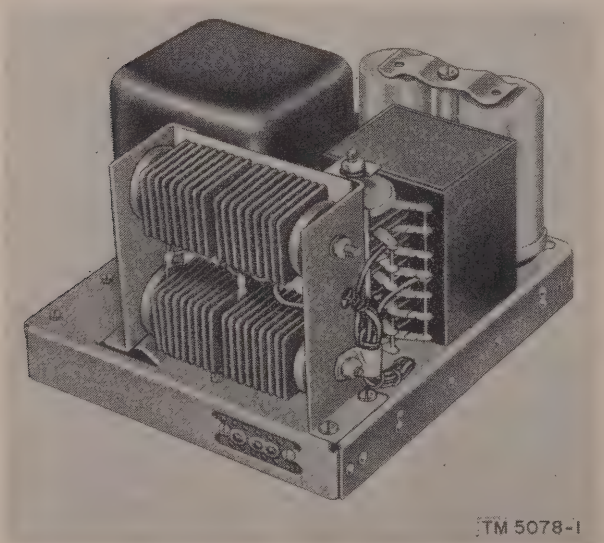


Figure 7. Power supply PP–846/U.

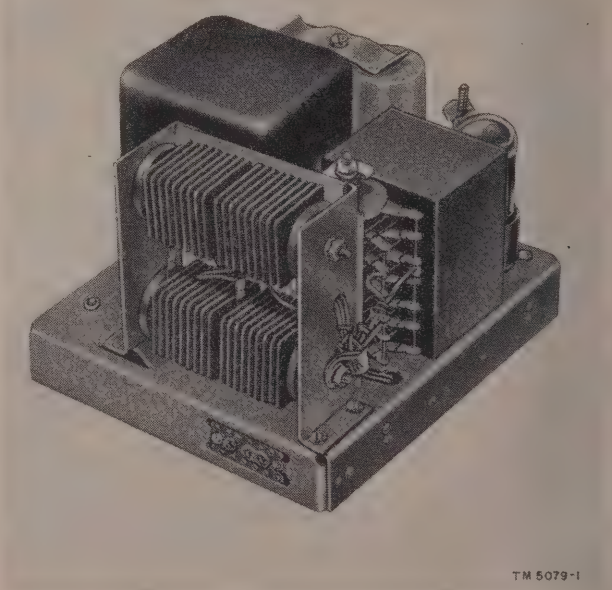


Figure 8. Power supply PP–867/U.

plies PP–868/U and PP–869/U are of the same general description, except that they are used with 12- and 6-volt storage batteries, respectively.

b. Differences in Models. Power Supplies PP–867/U, PP–868/U, and PP–869/U are very similar. They differ mainly in their input circuits and input voltage requirements. Power Supply PP–867/U (figs. 36 and 37) uses a 24-volt vibrator; Power Supply PP–868/U (fig. 38) uses a 12-volt vibrator; and Power Supply PP–869/U (fig. 39) uses a 6-volt vibrator. These vibrators are not interchangeable. The power supplies also differ in some components such as resistors, transformers, fuses, and capacitors, which are necessary to accommodate the different input voltages. The first few units produced of Power Supply PP–867/U do not have inductances in the vibrator circuit. These units bear serial numbers 1 through 56 on Order No. 11661–Phila–52 and have vibrator circuits as shown in figure 37.

17. Electrical Cables

a. Power Cable for Radio Receiving Set AN/FRR–36. The ac power cable (fig. 9) supplied with the ac receiving set (the AN/FRR–36) is made of heavy duty rubber-covered wire. The standard length is 15 feet. A male two-prong plug is attached to one end for connection to an ac outlet and the other end has a lug-type terminal on each conductor for connection to a terminal board in Electrical Equipment CY–1150/U (par. 25).

b. Coaxial Cable for Radio Receiving Set AN/FRR–36. The ac receiving set is connected to the antenna with a 100-foot length of Radio Frequency Cable RG–8A/U (Cord CG–399A/U) (fig. 9). This cable has a Radio Frequency Plug UG–21B/U on one end and a Plug PL–259 on the other end. The cable has a characteristic impedance of 52 ohms which is suitable for matching the input impedance of the ac receiving set to that of Antenna AT–438/GR.

c. Cables for Radio Receiving Set AN/VRR–7(*). The vehicular installation kit for the dc receiving set (the AN/VRR–7(*)) contains a power cable and a radio frequency (rf) cable with a 52-ohm impedance.

18. Description of Antennas

a. Antenna AT–438/GR (fig. 10), used with Radio Receiving Set AN/FRR–36, is a folded vertical radiator. Electrically it is similar to a quarter-wave vertical Marconi antenna. The counterpoise (artificial ground) of this fixed station antenna consists of four 30-inch rods placed in a horizontal plane beneath a vertical radiator. The antenna is coupled to the receiver through Radio Frequency Cable RG–8A/U, a 52-ohm transmission line. A 2-turn impedance-matching inductance is in series with the center lead of the cable and the ungrounded terminal of the folded radiator. A cylindrical housing protects the impedance-matching inductance and the coaxial connectors at the antenna. The rugged mechanical construction of the antenna permits its use under adverse weather conditions. The antenna mounting bracket can be attached to a cylindrical 5-foot mast supplied with the antenna. The outside diameter of the mast is approximately 1½ inches.

b. Antenna AT–496/G, used with Radio Receiving Set AN/VRR–7(*), is a whip-type, quarter-wave Marconi. It is intended for installa-

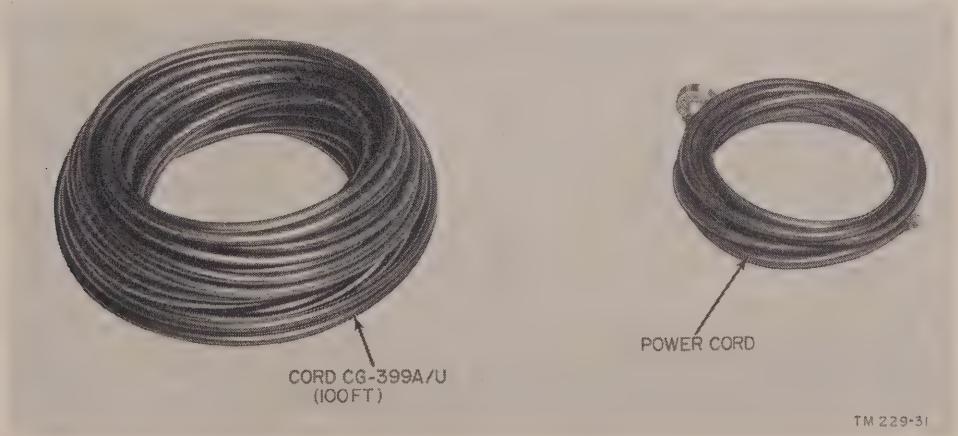


Figure 9. Radio receiving set AN/FRR–36, electrical cables.

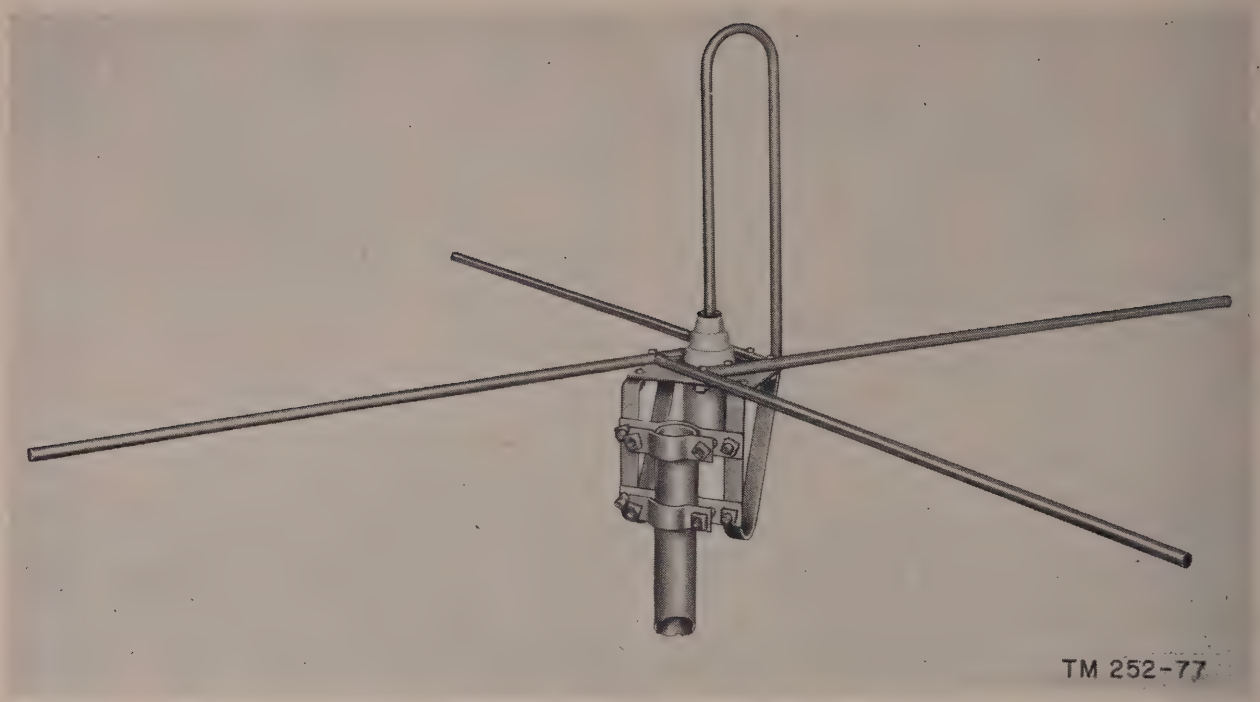


Figure 10. Antenna AT–438/GR.

tion in hard-top vehicles such as sedans and ambulances. This vehicular antenna has an over-all length of 17.3 inches and is coupled to the receiver through a 52-ohm coaxial transmission line.

c. For jeeps or similar vehicles, a small, vehicular, bumper-type antenna is provided in an installation kit.

19. Running Spares for Radio Receiving Set AN/FRR–36

a. Running spares are provided for Radio Receiving Set AN/FRR–36. These spares are for normally expendable items, such as tubes, fuses, and pilot lamps. Following is a list of the running spares for each radio receiving set:

2 tubes, 1AD4
1 tube, 5840
4 tubes, 5678
1 tube, 5783
1 tube, 6AK6
1 tube, 5672
1 Lamp LM–52, 6 to 8 volts, .15 amp.
5 fuses, 2 amp, 1¼ inches long by ¼-inch diameter, Signal Corps stock No. 3Z2602.29

b. Running spares are furnished with Radio Receiving Set AN/VRR–7(*) and are generally similar to those listed for the ac receiving set (*a* above). The fuses provided will be of appropriate value as determined by the dc power requirements (par. 26).

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

20. Siting

a. The best location for radio equipment depends on the tactical situation and local conditions, such as the following: need for concealment from enemy observation, type of housing available, installation in a vehicle, terrain, and need of easy access to messengers. Signals received on these radio receiving sets have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception and transmission because the surrounding high terrain absorbs rf energy.

b. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, power lines, hospitals, or power units. Choose, if possible, a location on a hilltop or other elevation. Flat ground is also suitable. Normally, transmission over water is better than over land. See that drainage is adequate to prevent flooding the interior of the shelter. If the equipment is part of a communication center but is not installed within the center, locate the equipment nearby. When locating the antenna, avoid obstructions between the transmitter and the receiving set (fig. 11).

21. Shelter Requirements

a. The shelter for Radio Receiving Set AN/FRR–36 must meet the following requirements:

(1) A table or bench must be provided for mounting the radio receiving set. It must be free of vibration and sturdy enough to support the weight of the equipment.

(2) Sufficient space must be provided on the operating table or bench so that the receiver may be removed from the cabinet.

(3) Protection from damp walls should be provided. Never locate the equipment near walls that show evidence of seepage or water flow from a leaking ceiling. If it is necessary to use a building with a concrete floor, locate the equipment where the floor appears the driest.

b. The shelter requirements for Radio Receiving Set AN/VRR–7(*) are met by mounting the equipment in the vehicle according to the instructions contained in the vehicular installation kit. To prevent water leakage, cable feedthrough gaskets must be carefully and properly installed.

22. Unpacking New Equipment

(figs. 12 and 13)

Caution: Rough handling while unpacking may damage the radio receiving sets; take every precaution to prevent damage. If possible, unpack the equipment in a location that is free from dust, dirt, and moisture. Save all packaging material for future repacking.

a. General. Exploded views of the two wooden crates that contain the components of Radio Receiving Set AN/FRR–36 are shown in figures 12 and 13 as an aid for unpacking equipment. (For used or reconditioned equipment, refer to par. 27.) Radio Receiving Set AN/FRR–36 may be packaged as shown in figure 12; Radio Receiving Set AN/VRR–7(*) will be similarly packed. Antenna AT–438/GR and its mast may be packaged as shown in figure 13.

b. Radio Receiving Set Crate (fig. 12).

(1) Place the packing crate as near the operating position as is convenient.

(2) Cut the encircling metal bands or wires close to the wooden crate-top along three sides. The remaining uncut bands or wires will serve as hinges for the wooden crate-top.

(3) Pry open the top cover; be careful not to force the prying instrument too far into the package. The lid will then hinge backward. Use a nailpuller if one is available. Save all packing material

Figure 11. Siting antenna AT–438/GR.

except the silica gel (dehydrating agent) for possible repacking.

(4) Carefully lift the outer carton from the wooden shipping crate.

(5) Open the outer carton by cutting along the flaps.

(6) Open the waterproof barrier bag by slitting it along the edge of its seal, and remove the inner carton with care so that the cabinet will not be scratched or dented.

(7) Open the inner carton by cutting along the flaps.

(8) Carefully lift the radio receiving set from the carton.

(9) Inspect the equipment for any damage during shipment.

(10) Check the contents of the shipping crate against the master packing list.

c. Antenna Crate (fig. 13).

(1) Proceed as instructed in *b*(1) through (3) above.

(2) Carefully lift the carton from the wooden shipping crate.

(3) Open the carton by cutting along the flaps.

(4) Remove the antenna components from the carton.

(5) Inspect the equipment for any damage during shipment.

(6) Check the contents of the shipping crate against the master packing list.

d. Mast Crate (fig. 13).

(1) Place the wooden packing crate as near the operating position as is convenient.

(2) Cut the encircling metal bands or wires close to the wooden crate-top along three sides only. The remaining uncut side will serve as a hinge for the wooden crate-top.

(3) Remove the mast section from the crate.

(4) Remove the cardboard tube from the mast section.

(5) Check the mast section for any damage during shipment.

23. Installation of Radio Receiving Set AN/FRR–36

a. Checking Equipment. Check each individual component as follows:

(1) *Electrical Equipment Cabinet CY–1150/U.* Inspect the outside of the cab-

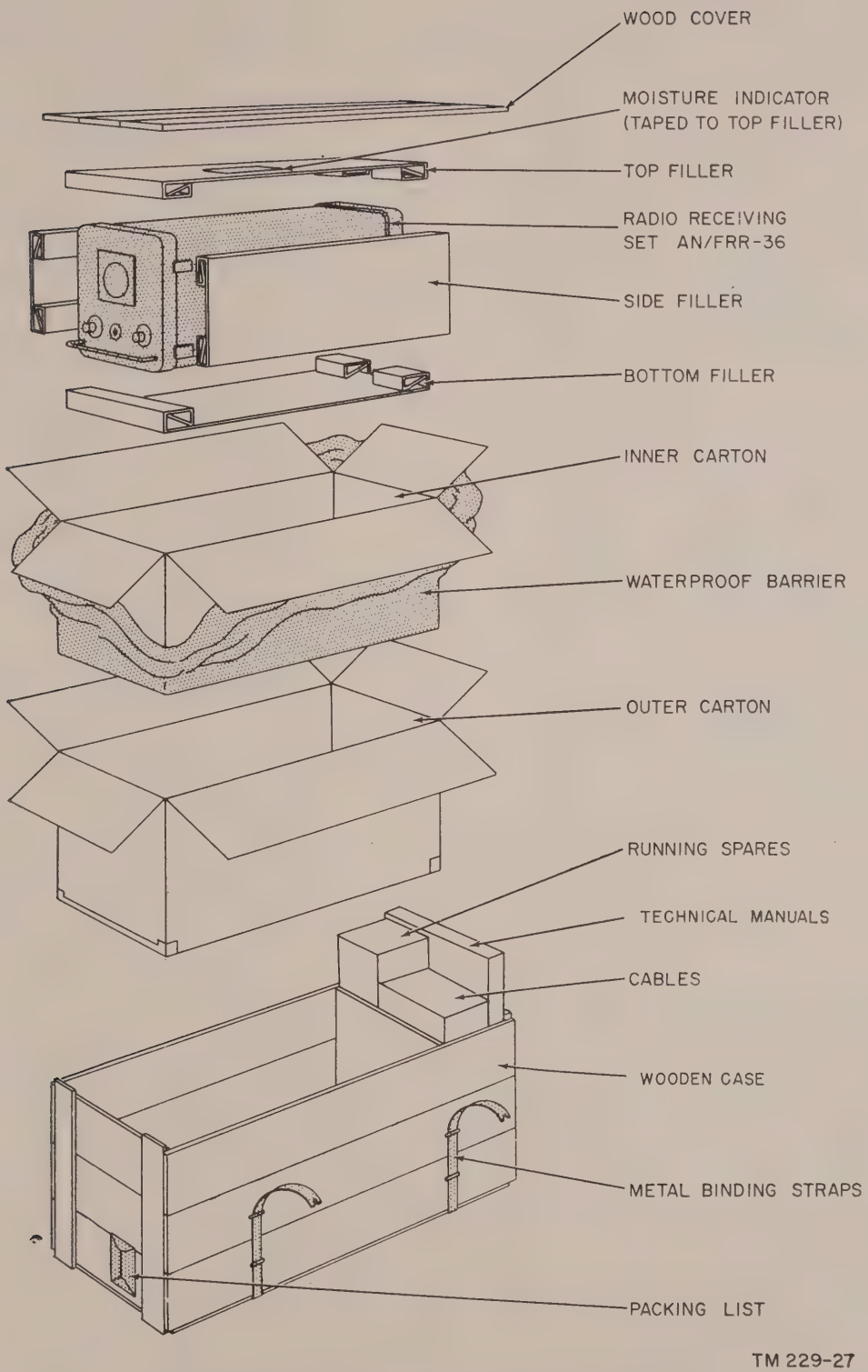


Figure 12. Packaging for radio receiving set AN/FRR-36.

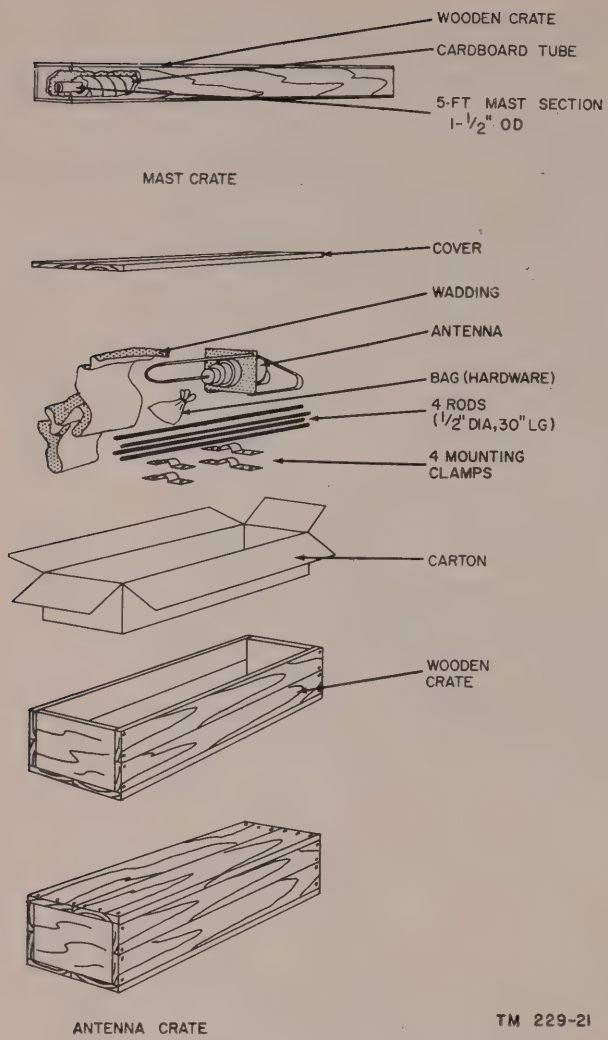


Figure 13. Packaging for antenna AT–438/GR.

inet for dents, scarred surfaces, and broken or loose control knobs. Open the front and rear covers of the cabinet by releasing the snap fasteners at either end. Inspect the antenna input connector at the bottom of the rear cover for damage (fig. 4). Inspect the components behind the front cover for bent parts, open leads, and frayed or cut wiring (fig. 30). After removing the receiver, inspect the inside of the cabinet for damage.

(2) *Radio Receiver R–394/U.* If the receiver has been shipped inside the cabinet, remove the receiver from the cabinet by turning the lock-in handle as shown on the knob (fig. 4) and pulling forward. The top cover of the receiver is secured in place with a latch at the rear of the receiver. The bottom is fastened with six Airloc fasteners. Remove the top and bottom covers and inspect for damage, dirt, and moisture. Be sure that a jumper is connected between terminals 7 and 8 of terminal board TB251 on the bottom of the receiver chassis. (See TM 11–5092.) Remove the plug-in units (fig. 6) and slide off the rectangular metal sleeves that shield them. Remove each sleeve by means of the handle and inspect each plug-in unit. At this point, the LOCAL OSC 152–174 MC plug-in unit can be checked for the proper crystal. If the crystal is to be replaced by another of a different frequency, do it immediately (par. 29). The LOCAL OSC 152–174 MC and the RF AMPL 152–174 MC plug-in units have holes in their protective sleeves that permit frequency-changing alinement to be performed after the receiver is completely reassembled. (Refer to TM 11–5092.)

(3) *Power Supply PP–846/U.* This power supply is shipped mounted in the receiver base. Remove the side cover of the receiver and inspect the bottom of the power supply. Most of the parts on the top of the chassis can be seen by looking down into the power supply compartment of the receiver. If further examination of the power supply is necessary, unplug the power supply connector at the bottom of the receiver; then remove six 10–32 screws (fig. 5), and lift the power supply out of the receiver base.

(4) *Antenna AT–438/GR* (fig. 16). Check the antenna assembly for completeness and damage to its parts such as the coaxial connector, insulators, and rods. Check the contents of the hardware bag. Antenna AT–438/GR is partially assembled when shipped.

(5) *Accessories.* Check all other equipment, such as spares and cables, for completeness and damage.

b. Reassembly. Reassemble the components checked in *a* above as follows:

(1) Replace the power supply in the receiver base and tighten the threaded fasteners (fig. 5). Make sure that the jack on the

power supply is connected to the plug on the bottom of the receiver chassis.

(2) Plug in the power supply connector from the bottom of the receiver.

(3) Replace the rectangular metal sleeve over the proper plug-in unit (fig. 6).

(4) Insert the plug-in units in their proper sockets in the receiver chassis (fig. 6).

(5) Replace the bottom cover of the receiver by tightening the six Airloc fasteners.

(6) Replace the top cover of the receiver and fasten the latch at the rear of the receiver.

(7) Slide the receiver into the cabinet and seat it firmly by turning the lock-in handle in the direction shown (fig. 4).

(8) Make sure that the antenna input connector is firmly connected at the rear cover of the cabinet (fig. 4).

(9) Replace the front and rear covers of the cabinet and fasten the four snap fasteners at either end.

c. Mounting the Radio Receiving Set. Mount the radio receiving set on a bench or table top with four 8–32 mounting screws. See figure 14 for the

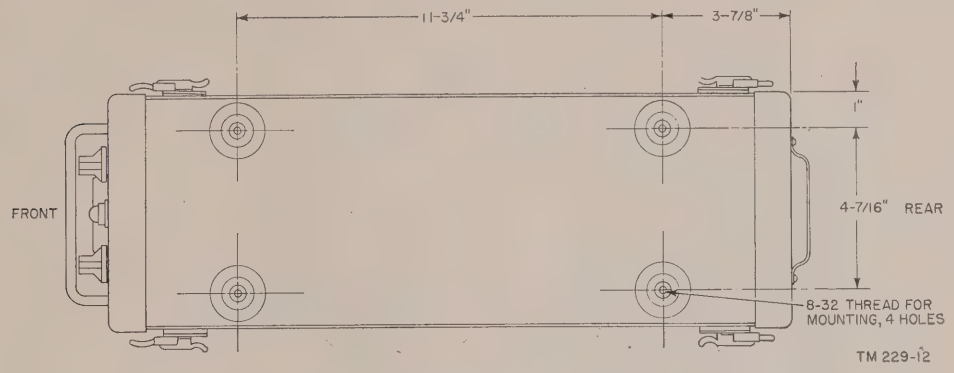


Figure 14. Radio receiving set AN/FRR–36, mounting dimensions.

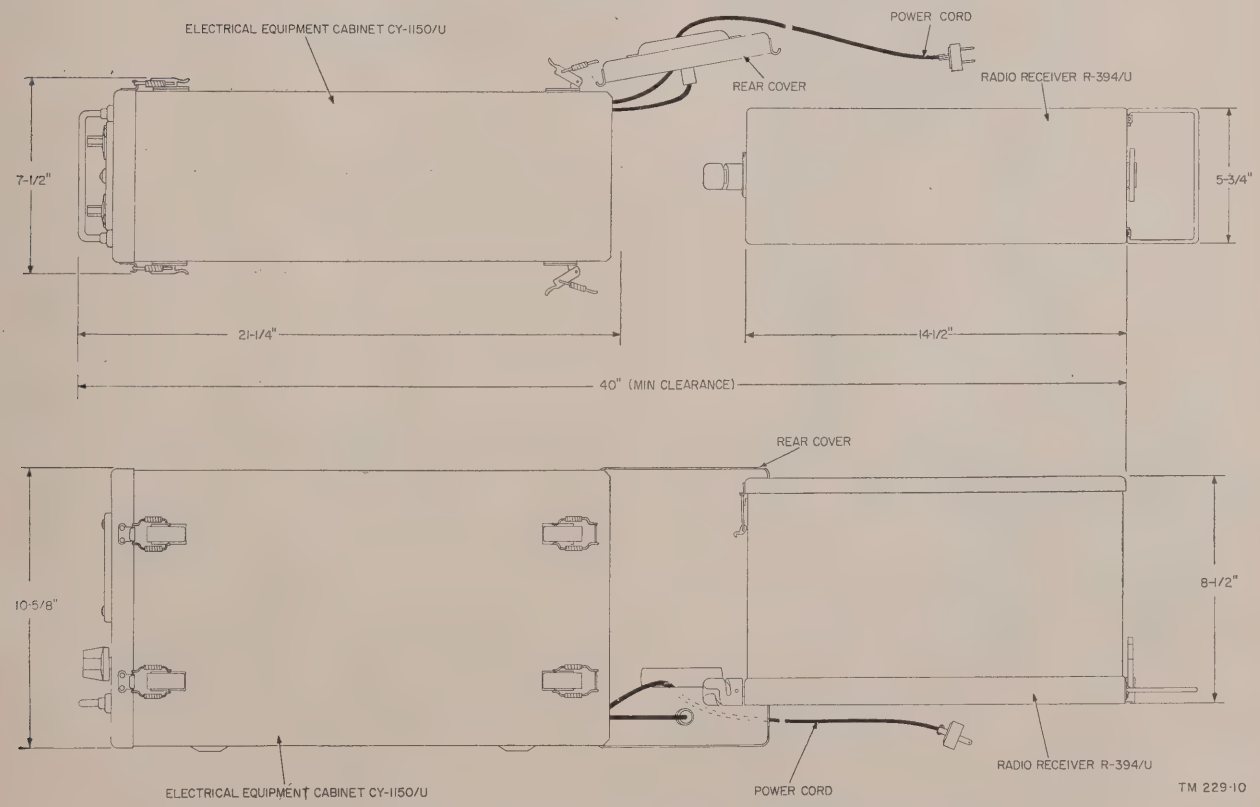


Figure 15. Radio receiving set AN/FRR–36, installation dimensions.

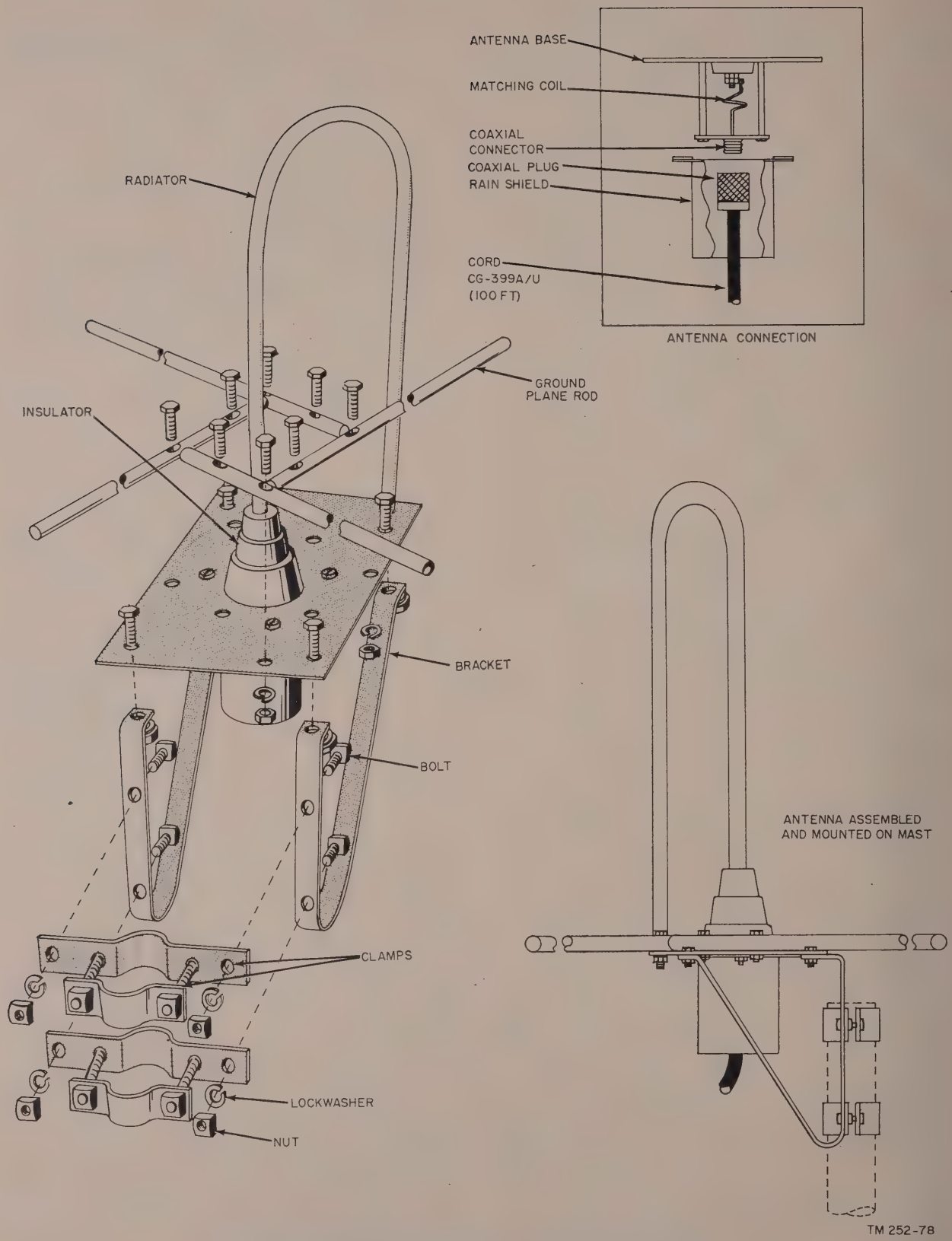


Figure 16. Antenna AT-438/GR, assembly and installation.

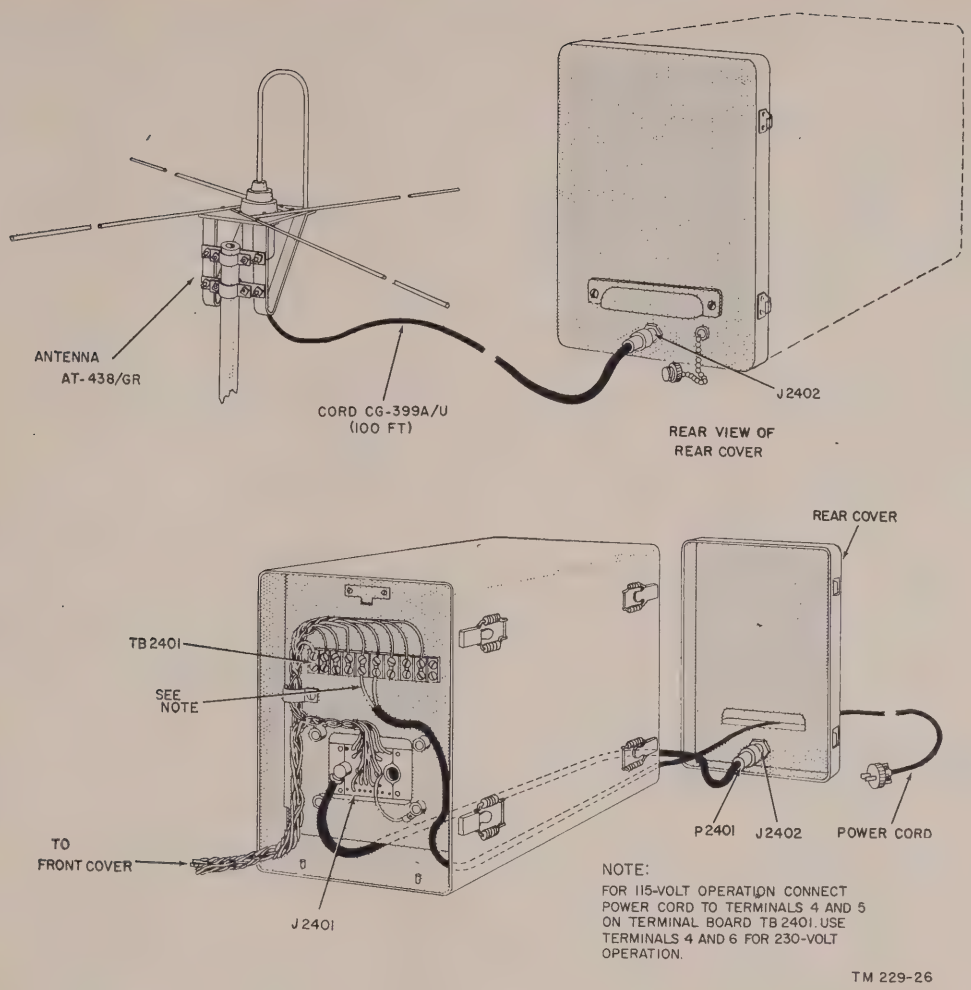


Figure 17. Radio receiving set AN/FRR–36, connections.

location of the mounting holes. Overall installation dimensions of the receiving set are shown in figure 15.

d. Assembling the Antenna (fig. 16). Assemble the antenna as follows:

(1) Fasten each ground plane rod to the top of the antenna base with two bolts and nuts. Use a lockwasher under each nut in this and all similar connections.

(2) Bolt the two antenna brackets to the base plate.

(3) Bolt the antenna bracket to the two larger mast clamps.

(4) Bolt the entire mast clamp assembly securely around a 1½-inch diameter pipe. (A 5-foot mast section is furnished with the radio receiving set.)

(5) Make the transmission line connection by screwing the coaxial plug on the antenna coaxial connector.

(6) Raise the antenna mast with the completed antenna assembly. For mast pipes over 20 feet (not furnished), reinforce the antenna assembly with guy wires or ropes.

(7) Securely anchor the base of the antenna mast against the vertical side or roof of a building. In general, any reasonably high structure will be suitable.

(8) Connect the other end of the transmission line to the antenna connector on the back of the cabinet.

24. Installation of Radio Receiving Set AN/VRR–7(*)

Installation instructions for Radio Receiving Set AN/VRR–7(*) are contained in each vehicu-

lar installation kit. Information on vehicular installation kits is contained in SB 11–131.

25. Connections and Interconnections

a. Radio Receiving Set AN/FRR–36.

(1) *Power cord.* Feed the power cord through Electrical Equipment Cabinet CY–1150/U to terminal board TB2401 (fig. 17). If the ac power source is 115 volts, connect the ends of the cord to terminals 4 and 5 (fig. 18). If the power source is 230 volts, connect the ends of the cord to terminals 4 and 6.

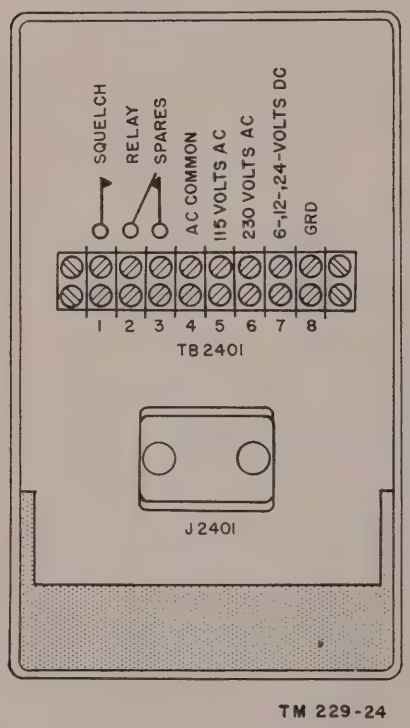


Figure 18. Radio receiving AN/FRR–36, front panel terminal board.

(2) *Antenna cable.* Connect the antena cable to J2402 on the rear cover of the cabinet (fig. 17). Be sure that P2401 is connected to J2402 on the inner side of the rear cover.

(3) *Relay connections.* When a call-light is needed, a relay plug-in unit (Receiver Subassembly MX–1547/G), may be used in the receiver to control the light. If the relay is used, the wires from the external circuit should be connected to terminals 1, 2, and 3 on terminal board TB2401. These wires may be fed through the louver in the rear cover. The relay contacts and the correct terminals are shown in the schematic diagram of Electrical Equipment Cabinet CY–1150/U (fig. 34).

b. Radio Set AN/VRR–7(*). Connections and interconnection for the dc receiving set are similar to those of the ac receiving set described in *a* above. Complete installation instructions will be contained in installation kits issued with the equipment.

26. Fuse Location

a. Each radio receiving set is shipped with one fuse installed in the power input circuit of its power supply. There is also one spare fuse. Carefully check each fuse for correct current rating. For fuse location, see figure 19.

b. The following chart details correct fuse data:

Radio Receiving Set	Power Supply	Fuse used	Rating (amp)
AN/FRR–36	PP–846/U	F3001 F3002 (spare)	2
AN/VRR–7	PP–867/U	F2901 F2903 (spare)	3
AN/VRR–7X	PP–868/U	F2801 F2802 (spare)	5
AN/VRR–7Y	PP–869/U	F2701 F2702 (spare)	8

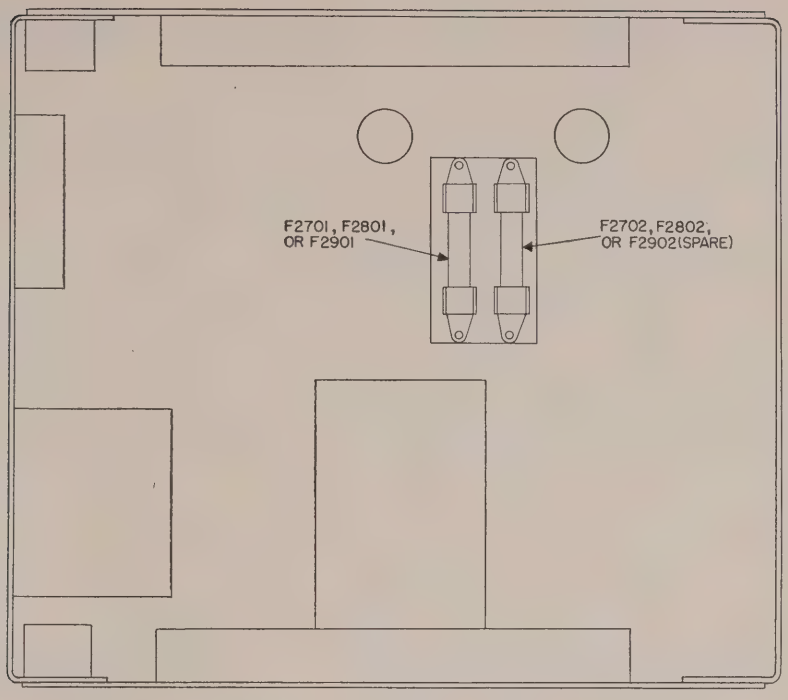
27. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 22 for unpacking and checking the equipment.

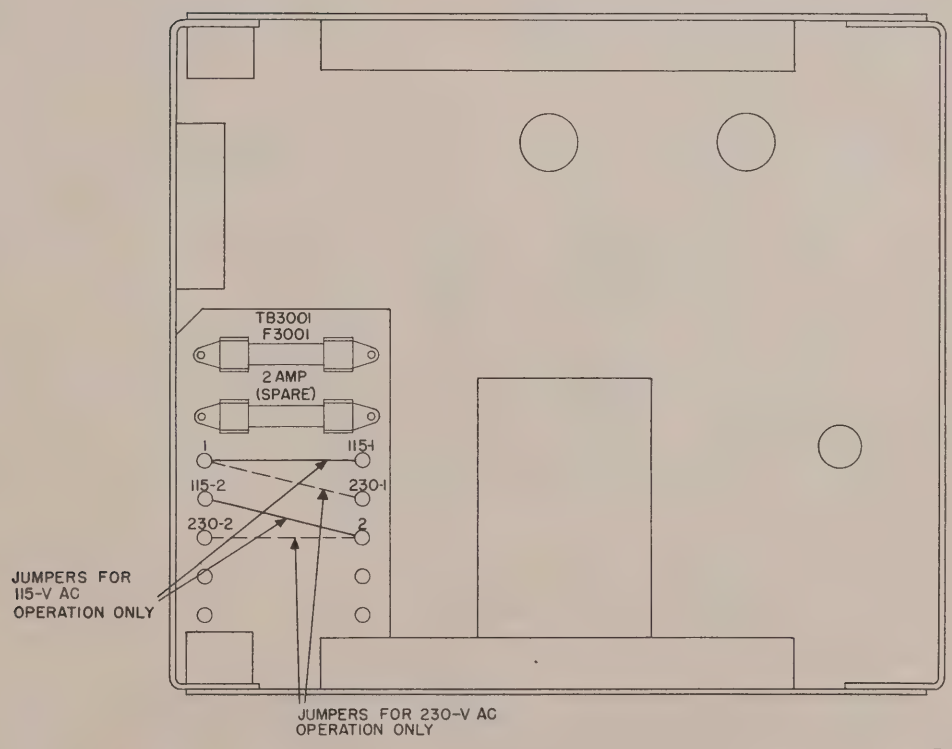
b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes have been made, note them in the technical manual preferably on the schematic diagram.

c. If a new Radio Receiver R–394/U is available, compare the reconditioned receiver with the new receiver. Refer to the final testing section in TM 11–5092.

d. Follow the installation and connection procedures given in paragraphs 23 through 25.



BOTTOM VIEW OF DC POWER SUPPLIES A



BOTTOM VIEW OF POWER SUPPLY PP-846/U. B

TM229-8

Figure 19. Fuse locations.

28. Receiver Test Points

a. There are eight test jacks on the front of Radio Receiver R–394/U (fig. 20). These test points aid in alining the receiver (par. 29). Rf or intermediate-frequency (if.) signals are decoupled from these test points to prevent loading or detuning of the circuits being tested. A quick check for B+ and filament voltages also can be made at these test points.

b. The repairman should study TM 11–5092 to become familiar with the features and details of the receiver. The schematic diagram of Radio Receiver R–394/U (fig. 33) indicates the test points and their connections in the receiver circuit.

29. Preliminary Procedures for Changing Frequency

a. General. Alinement of the hf oscillator, multiplier, and rf amplifier stages is required when it becomes necessary to install a new crystal in the receiver. Additional alinement procedures should not be needed for simple crystal changing but if they are found necessary, refer to TM 11–5092. Paragraphs 30 through 32 detail all essential alinement procedures for crystal changing in the receiver. All adjustments described in these paragraphs are to be performed by qualified personnel only.

b. Initial Steps. The following initial steps should be taken:

(1) Release the receiver from its cabinet by turning the hold-in lock handle counterclockwise. The receiver then may be pulled out of the case by using a folding handle located on the front panel.

(2) Remove the top cover and the two plug-in assemblies marked LOCAL OSC 152–174 MC and RF AMPL 152–174 MC (fig. 6).

(3) Do not replace the shields of these plug-in units until the frequency changing procedure is completed.

(4) Remove crystal oven assembly E31 (first hf oscillator) crystal oven from the LOCAL OSC 152–174 MC plug-in unit (fig. 21). Remove its cover plate and replace crystal Y31 with the new crystal. Be sure not to interchange the plug-in positions of the crystal and the thermostat. The thermostat is painted black. The

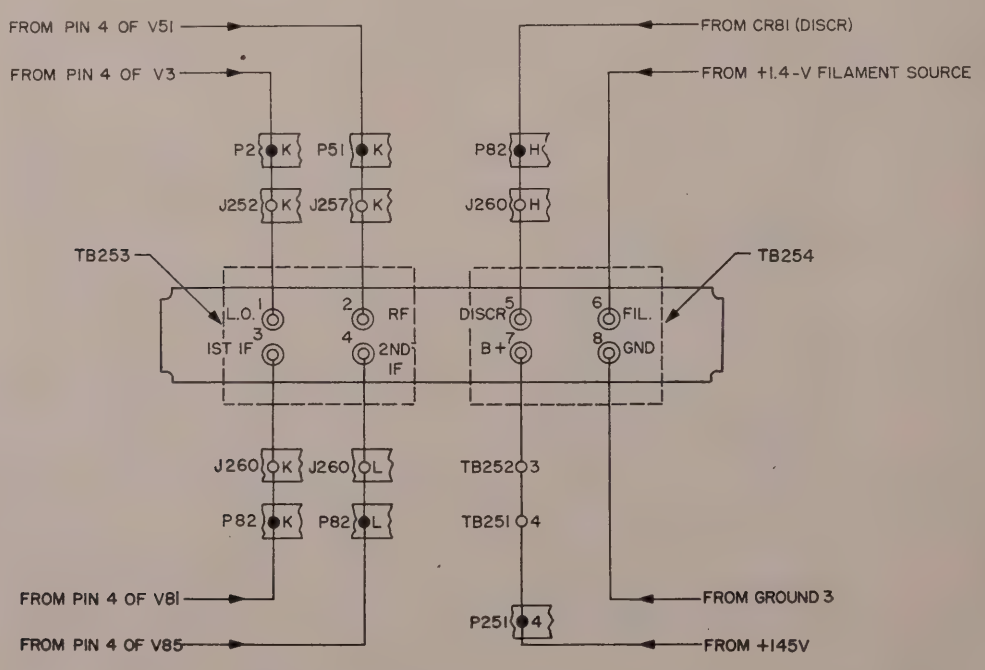


Figure 20. Radio receiver R–394/U, test points.

crystal frequency is determined by the following formula:

$$\text{Crystal frequency (mc)} = \frac{F - 7.8}{6}$$

where F = frequency (in mc) of operation desired.

(5) Reassemble crystal oven assembly E31 and replace it in the octal socket in the plug-in unit.

(6) Insert the LOCAL OSC 152–174 MC and the RF AMPL 152–174 MC plug-in units in the receiver with their shields removed.

(7) Use Electrical Special Purpose Cable Assembly CX–2371/U to complete the connections from the receiver to Electrical Equipment Cabinet CY–1150/U or CY–1223/G (fig. 29). This special purpose cable will be listed in SIG 7 & 8 AN/FRR–36. Authorization for requisitioning this cable will be found in SB 11–170, Test Cable for Maintenance of Nontactical Series Radio Sets.

30. Hf Oscillator and Multiplier Alinement Procedures

(figs. 22 and 23)

Connect a vacuum-tube voltmeter (vtvm), such as Electronic Multimeter TS–505/U, and make alinement adjustments as described in the following chart:

Connection	Adjustment	Indication
None	Z31 unscrewed almost all the way counterclockwise.	None.
R40 at terminal on TB31 and GND test points.	Z31	Maximum negative voltage.
R34 at terminal on TB31 and GND test points.	Z32 and Z33	Maximum negative voltage.
L. O. and GND test points	Z34	Maximum negative voltage.

31. Rf Amplifier Alinement

(figs. 20 and 23)

a. Presetting Tuning Cores. Before alining the RF AMPL 152–174 MC plug-in unit, preset the tuning core slugs to allow a signal to pass through the detuned stages. To do this, adjust the tuning cores to their approximate correct positions. The chart below lists various receiver frequencies and the corresponding number of turns that the tuning cores must be adjusted for each frequency. Columns 2 and 3 list the number of turns that the core slugs must be turned *in* from the extreme counterclockwise positions. To use these two columns, the five tuning cores (Z1, Z2, Z3, Z4, and Z5) first must be turned to their extreme counterclockwise positions. In these positions, the tops of the screws will extend approximately thirteen-sixteenths of an inch above the chassis. If the equipment is received directly from the factory, it is not necessary to turn all slugs to the extreme counterclockwise position before presetting. The receivers are tuned for 165.075 mc at the factory, and column 4 lists the direction and number of turns that the tuning cores must be changed from the factory-set position. A spot of paint or some mark on the alinement tool will make it easier to count the number of turns. Tuning slug Z6 is preset to 7.8 mc at the factory and must not be disturbed until all other coils have been alined.

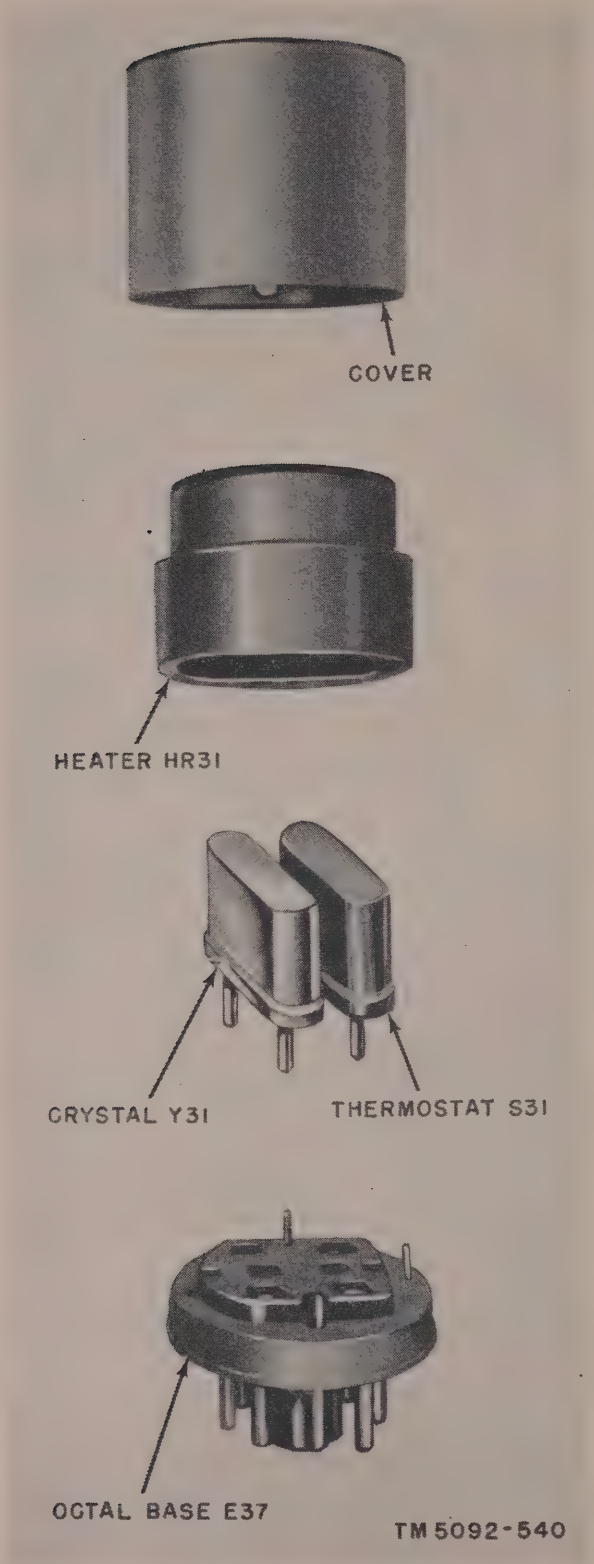


Figure 21. Radio receiver R–394/U, crystal oven E31, disassembled.

1	2	3	4
Receiver frequency (mc)	Number of clockwise turns of tuning core		Number of turns of tuning cores from factory-set position (Z1, Z2, Z3, Z4, and Z5)
	Z1, Z2, Z4	Z3, Z5	
152	7	9	10 out (counterclockwise).
153	8	10	9 out (counterclockwise).
154	9	11	8 out (counterclockwise).
155	10	12	7 out (counterclockwise).
156	10¾	12¾	6¼ out (counterclockwise).
157	11½	13½	5½ out (counterclockwise).
158	12¼	14¼	4¾ out (counterclockwise).
159	13	15	4 out (counterclockwise).
160	13¾	15¾	3¼ out (counterclockwise).
161	14½	16½	2½ out (counterclockwise).
162	15¼	17¼	1¾ out (counterclockwise).
163	15¾	17¾	1¼ out (counterclockwise).
164	16½	18½	½ out (counterclockwise).
165	17	19	0.
166	17¾	19¾	¾ in (clockwise).
167	18½	20½	1½ in (clockwise).
168	19¼	21¼	2¼ in (clockwise).
169	20¼	22¼	3¼ in (clockwise).
170	21	23	4 in (clockwise).
171	21¾	23¾	4¾ in (clockwise).
172	22½	24½	5½ in (clockwise).
173	23¼	25¼	6¼ in (clockwise).
174	24	26	7 in (clockwise).

b. Final Adjustment. After the RF AMPL 152–174 MC plug-in unit has been preset approximately, it must be accurately alined. To perform this accurate alinement, use the following procedure:

(1) Connect a signal generator between the antenna coaxial connector J2402 (fig. 17) and chassis ground. Set the signal generator output to 20 microvolts. This should be sufficient to allow a signal to pass through the preset stages.

(2) Connect a vtvm between the 2ND IF and GND test points located on the front panel of the receiver (fig. 20).

(3) Adjust Z1, Z2, Z3, Z4, and Z5 for a maximum negative output as indicated on the meter. Repeat this procedure at least three times. If the vtvm reads off-scale, reduce the signal generator output.

Caution: Do not adjust Z6 (fig. 23) during any of the crystal changing alinement procedures.

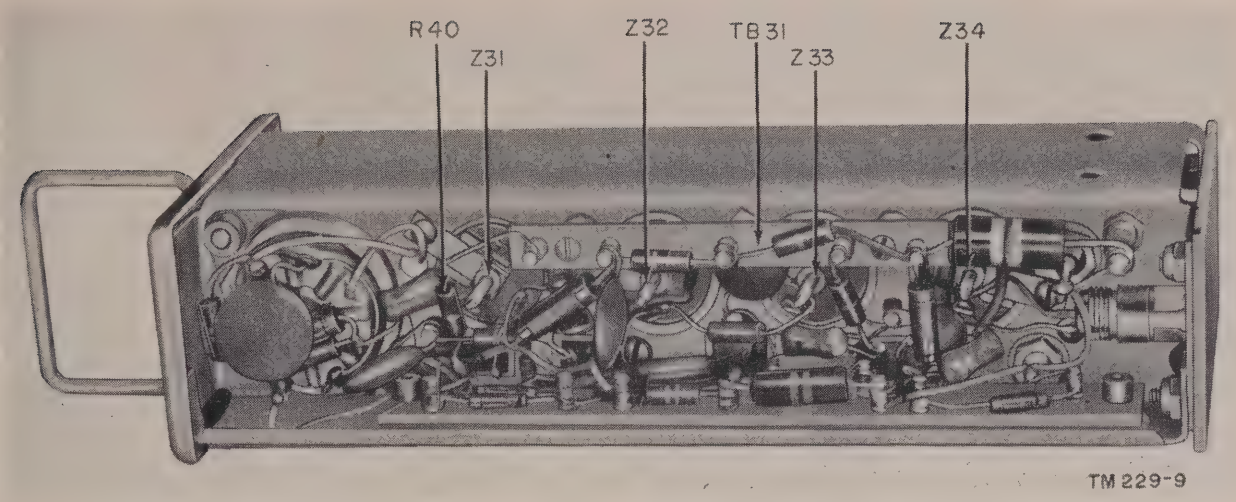


Figure 22. Radio receiver R–394/U, LOCAL OSC 152–174 MC plug-in unit, test and alinement points.

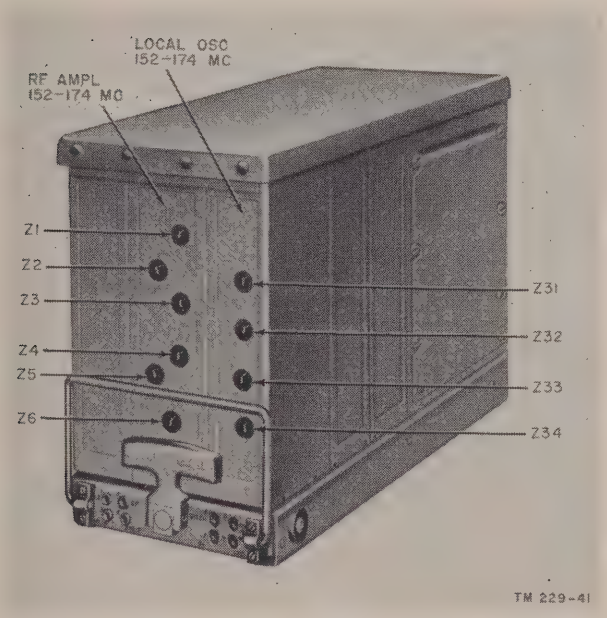


Figure 23. Radio receiver R–394/U frequency changing alinement points for the rf and high frequency oscillator stages.

32. Adjusting Receiver to Exact Transmitter Frequency

Usually, it is not possible to aline the receiver exactly to the distant transmitter frequency by use of a signal generator. A slight adjustment of the hf crystal oscillator is necessary for precise alinement. The procedure is as follows:

a. Place the receiver in operation as described in paragraphs 35 through 37. Make sure the transmitter is operating on the desired signal frequency. The radio receiving set must be connected to an antenna for this adjustment.

b. Connect a vtvm to the front panel test points marked DISCR and GND.

c. Adjust the oscillator warping coil Z31 for a +1-volt reading on the vtvm (fig. 22).

d. The receiver now is accurately adjusted to the new operating frequency. Put the plug-in unit shields on the plug-in units and insert the plug-in units in the receiver base assembly. Disconnect the patch cord and replace the receiver in Electrical Equipment Cabinet CY–1150/U.

CHAPTER 3

OPERATION

Section I. OPERATION UNDER USUAL CONDITIONS

33. Controls and Their Uses
(fig. 24)

The following chart lists the controls of both Radio Receiving Sets AN/FRR–36 and AN/VRR–7(*) and the function of each item. These controls are contained in either Electrical Equipment Cabinet CY–1150/U or CY–1223/G.

Control	Function
SQUELCH control R2408	Sets squelch threshold or sensitivity level, as determined by operator of receiver. Minimum squelch action is in clockwise direction.
SQUELCH-OFF switch S2402	Ganged to R2408. In extreme clockwise position, switch is closed and prevents squelch circuit from operating.
VOLUME control S2401A	Audio level step attenuator. Operator has option of four fixed audio levels. Maximum volume is in extreme clockwise position.
Power OFF switch S2401B	Ganged with VOLUME control. In extreme counterclockwise position, switch opens circuit to ac or dc power source.
POWER indicator lamp	Lamp lights when power is turned on.

34. General

The only adjustments required of the operator are to turn the receiving set on and to adjust the squelch control. Details covering this are found in paragraphs 35 through 37.

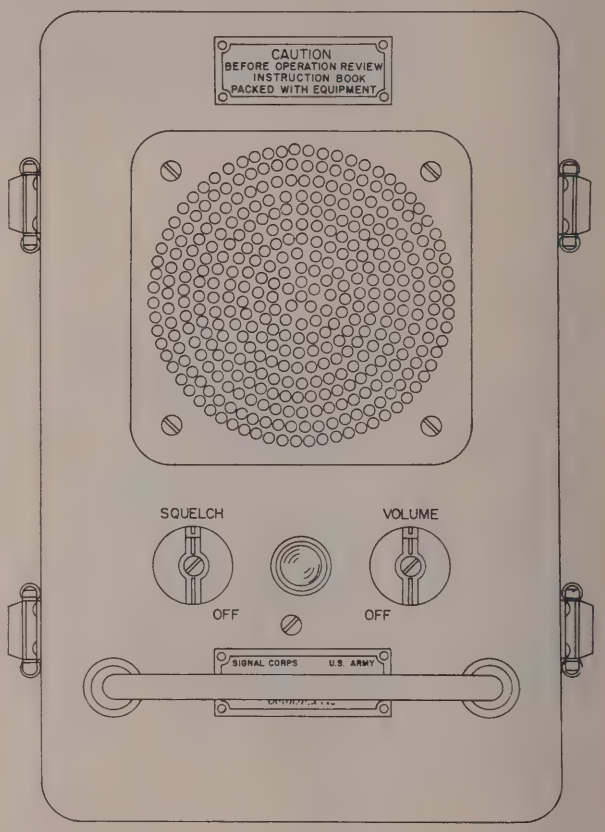


Figure 24. Radio receiving set AN/FRR–36, controls.

35. Starting Procedure
(fig. 24)

a. Preliminary. Set the controls on the front panel of the receiving set as follows:

Control	Position
VOLUME	OFF.
SQUELCH	OFF.

b. Starting. Turn the VOLUME control to the third or fourth position clockwise. The POWER indicator lamp will light and a signal or rushing noise will be heard from the speaker within 15 or 20 seconds.

36. Volume Adjustment

The volume of the receiver is adjusted by advancing the VOLUME switch clockwise for more output. The operator can select either of four audio volume levels. The lowest volume level is the first position clockwise from the OFF position, and the maximum volume level is obtained when the switch is fully clockwise. Adjust the control for a comfortable audio level.

37. Squelch Adjustment

(fig. 24)

When the SQUELCH control is in the OFF position, the receiver cannot be squelched. This permits the receiver to operate even without a received signal. The SQUELCH control is adjusted to mute the receiver output (rushing noise) when no signal is being received. Turn the squelch control slowly counterclockwise until the rushing noise stops. Wait until a signal is received. This received signal should unsquelch the receiver and allow normal operation. The receiver should again squelch as soon as the signal is no longer received. If the receiver does not squelch again, turn the SQUELCH control slightly in the same direction (counterclockwise). The setting at which this occurs is called the squelch threshold. Do not turn the control past the point where the rushing noise stops because weak signals will not be heard. If the noise level is high and the signal level low, squelch operation may be impossible. Under these conditions operation may be carried out with the SQUELCH control in the OFF position.

38. Antijamming Procedures

Radio Receiver R–394/U has fixed frequency design characteristics, and the frequency cannot be varied without considerable trouble. There is, therefore, little choice as to procedure in overcoming any type of jamming action. When the receiver is jammed by an enemy signal, follow the procedure in the order indicated below, if possible, until signal read-through is established.

a. Place the SQUELCH control in the OFF position. Some read-through may result.

b. Advance the VOLUME-OFF control to maximum volume. A strong jamming signal may overload the speaker and permit some degree of read-through.

c. Change the direction, position, and height of the antenna. These changes may have a favorable read-through effect on the desired signal.

d. If the antenna is vertical, try it at various angles until it is horizontal. If it is horizontal, try it at various angles until it is vertical.

e. Place the antenna so that some object such as a tree, tank, jeep, etc., is between it and the source of jamming. This may reduce greatly the strength of the jamming signal.

f. If facilities for changing frequency are available, request a change in frequency and call sign.

g. If the jamming action is so complete and effective that alternate frequencies do not permit communication, use some other means of getting the message through.

h. Continue to operate. This will keep the enemy uncertain as to his jamming success, and he will probably not move to another frequency. His equipment will be tied down to what he believes is an active frequency.

39. Stopping Procedure

Turn the VOLUME control counterclockwise to its OFF position. No further control settings are necessary.

Section II. OPERATION UNDER UNUSUAL CONDITIONS

40. General

The operation of Radio Receiving Set AN/FRR–36 or AN/VRR–7(*) may be difficult in regions where extreme cold, heat, moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given for minimizing the effect of these unusual operating conditions.

41. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the radio receiving set is not in a heated room or inclosure, construct an insulated box for the receiver. An illuminated electric light bulb placed in the insulated box will keep the receiving set warm when it is not in operation.

c. When a radio receiving set which has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

42. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or when necessary, in underground dugouts. When equipment is installed below ground, and when it is set up in swampy areas, moisture conditions are more acute than normal in the Tropics. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. To minimize this condition, place lighted electric bulbs near the equipment. Wipe off moisture when necessary.

43. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, or dirt that enters the moving parts of radio equipment, such as motors and power units. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of the tent with sand to prevent flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. PREVENTIVE MAINTENANCE SERVICES

44. Tools and Equipment

a. General. The tools, parts, supplies, and test equipment necessary to perform organizational maintenance are authorized by appropriate publications. One additional tool is supplied with either the ac or dc receiving set.

b. Special Alinement Tool Supplied with Either Radio Set AN/FRR–36 or AN/VRR–7(*).

(1) A nylon alinement tool is supplied with either the ac or dc receiving sets for adjusting the tuned circuits in Radio Receiver R–394/U.

(2) One end of this alinement tool is hollow with a slotted metal insert which engages the tuned-circuit adjusting screws. The other end of the tool is shaped like a conventional screwdriver blade. This alinement tool is fastened inside the rear cover of either the ac or dc cabinets with two clips (fig. 4).

45. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring.

46. General Preventive Maintenance Techniques

a. Use No. 000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result. Do not use compressed air in the vicinity of speaker cones or meter movements.

Caution: When using compressed air, always direct the first blast toward the floor to clear condensed moisture from the line.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

47. Use of Preventive Maintenance Forms (figs. 25 and 26)

a. The decision as to which items on DA Forms 11–238 and 11–239 are applicable to this equipment is to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 25 and 26 are partially or totally applicable to either Radio Receiving Set AN/FRR–36 or AN/VRR–7(*). References in the ITEM block refer to paragraphs in the text which contain additional maintenance information.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO RECEIVING SET AN/FRR-36

EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.

NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 48a							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 48b							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 48c							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 48d							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 48e							
6	CHECK FOR NORMAL OPERATION. PAR. 48f							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 48g		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 48h		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 48m	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 48i		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 48j		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 48n	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 48k		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 48o	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 48l		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. PAR. 48p	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

Figure 25. DA Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO RECEIVING SET AN/FRR-36

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO	ITEM	CONDITION
(1)	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 48a	
(2)	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 48b	
(3)	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 48c	
(4)	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 48d	
(5)	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 48e	
(6)	CHECK FOR NORMAL OPERATION. PAR. 48f	
(7)	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 48g	
(8)	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 48h	
(9)	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 48i	
(10)	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 48j	
(11)	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 48k	
(12)	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 48l	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
(14)	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 48m	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
(16)	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. PAR. 48n	
(17)	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. PAR. 48o	
(18)	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. PAR. 48p	

NO.	ITEM	CONDITION
19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.	
20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	
(24)	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 49a	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.	
(26)	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 49b	
(27)	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 49c	
28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
(31)	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 49d	
(32)	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR 49e	
33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
(36)	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. PAR 49f	
(37)	MOISTURE AND FUNGIPROOF. PAR. 49g	

38 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 66—16—64382-1

TM 229-19

Figure 26. DA Form 11–239.

48. Performing Exterior Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will become damaged or broken.

a. Check for completeness of the radio receiving set (receiver, power supply, cabinet, antenna, cables, wires, and technical manuals) (pars. 10 and 11).

b. Check the radio set for suitable location and installation (pars. 23 and 24).

c. Clean dirt and moisture from antenna, jacks, plugs, and component panels.

d. Inspect seating of readily accessible *pluck-out* items such as tubes, lamps, and fuses.

e. Inspect VOLUME and SQUELCH controls for binding, scraping, excessive looseness, and positive action.

f. Check for normal operation (pars. 35 through 37).

g. Clean and tighten exterior of components on Electrical Equipment Cabinet CY–1150/U or CY–1223/G. Check all cable connections.

h. Inspect mountings, antenna, and exposed metal surfaces for rust, corrosion, and moisture.

i. Inspect cords, cables, wires, and shock mounts for cuts, breaks, fraying, deterioration, kinks, and strain.

j. Inspect antenna for bent mast section, corrosion, loose fit, and damaged insulators.

k. Inspect cabling and technical manuals for mildew, tears, and fraying.

l. Inspect for looseness of accessible items such as switches, knobs, connectors, and pilot light.

m. Clean nameplates and jewel assembly.

n. Inspect shelter or cover for adequacy of weatherproofing (par. 21).

o. Inspect antenna guy wires for looseness or proper tension.

p. Inspect cabinet covers for cracks, leaks, damaged gaskets, and dirt.

49. Performing Interior Preventive Maintenance

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation (pars. 35–37).

a. Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration and moisture.

b. Clean and tighten switches and terminal board. Clean the interior of cabinet (fig. 30).

c. Inspect terminal board TB2401 on Radio Receiving Set AN/FRR–36 (fig. 30) for loose connections, cracks and breaks. Make similar inspection on identical type terminal board of Radio Receiving Set AN/VRR–7(*).

d. Clean and tighten connections and mountings for potentiometers.

e. Check power transformer and potentiometers for overheating.

f. Inspect for leaking waterproof gaskets, worn or loose parts.

g. Check moistureproofing and fungiproofing. (Refer to TB SIG 13).

h. Check the exterior and interior preventive maintenance items for Radio Receiver R–394/U and the appropriate ac or dc power supply.

Section II. LUBRICATION AND WEATHERPROOFING

50. Lubrication

No lubrication is required for the operation of this equipment.

51. Weatherproofing

a. General. Signal Corps equipment, when operated under severe conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72. The equipment is given the moistureproofing and fungiproofing at the factory and it is necessary to repeat the treatment only when parts are repaired or replaced.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas

subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

52. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touchup job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. For further information on painting equipment, refer to TM 9–2851.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

Note. Troubleshooting information on Radio Receiver R–394/U, for field maintenance personnel will be found in TM 11–5092.

53. Extent of Instructions

a. Troubleshooting at an organizational level is limited to the localizing of defective parts that are readily replaceable at an organizational level (tubes, fuses, cables, etc.) or to the sectionalizing of defective units that must be replaced as a unit (cabinet, receiver, or power supply). The procedures described are designed to determine first the defective unit and then the nature of the fault within the unit. If the fault can be determined through organizational procedures, corrective measures or the need for repair at a field maintenance level is indicated. If the fault cannot be determined through organizational procedures, reference is made to the necessary field maintenance instructions.

b. The techniques that are utilized for organizational troubleshooting include visual inspection, operational tests, tube tests, and simple continuity checks. The material is presented in the order which the repairman would normally employ when servicing a defective radio receiving set. When the procedures indicated are not sufficient to determine the source of trouble, troubleshooting at field maintenance level (pars. 67–78) will be required.

54. Visual Inspection

a. When failure is encountered and the cause is not immediately apparent, check as many of the items listed in *b* and *c* below as is practicable before starting a systematic operational check of the equipment. Do not, however, disassemble the set for a complete inspection without some knowledge of operational symptoms. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

b. Complete failure of the radio receiving set often may be caused by one or more of the following faults:

(1) Improperly connected power cable.
(2) Burned-out fuses (fig. 19).
(3) Worn, broken, or disconnected cords or plugs.

c. Partial failure of the radio receiving set may be caused by one or more of the following faults:

(1) Broken wires.
(2) Defective tubes. (See TM 11–5092.)
(3) Dirty or cracked (inactive) crystal. (See TM 11–5092.)
(4) Defective antenna connections.

55. Troubleshooting by Using Equipment Performance Check List

a. General. The equipment performance check list (par. 56) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. If the recommended corrective measures do not yield results, higher echelon maintenance is necessary (pars. 67–78). However, if the tactical situation requires that communication be maintained, and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

56. Equipment Performance Check List for Radio Receiving Set AN/FRR–36

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Antenna AT–438/FR	Coaxial cable connected to J2402.		
	2	Power source	Power cable connected to terminals 4 and 5 on TB2401 for 115-volt ac, or to terminals 4 and 6 for 230-volt ac operation (fig. 18).		
	3	SQUELCH control	Set at OFF.		
	4	VOLUME control	Set at OFF.		
	5	Receiver	Properly connected in cabinet.		
START	6	VOLUME control	Turn control clockwise 2 or 3 positions.	POWER indicator lamp lights; rushing noise or signal heard in receiver.	Check power source, power cable, power supply connector P251, receiver connector P252, and VOLUME control S2401A; check receiver (Refer to TM 11–5092.)
EQUIPMENT PERFORMANCE	7	VOLUME control	Turn control fully clockwise.	Signal or noise at maximum volume.	Check VOLUME control S2401A. Check receiver. (Refer to TM 11–5092.)
	8	SQUELCH control	With no signal and only noise being heard, turn control slowly counterclockwise.	Receiver quiets. An incoming test signal should unsquelch the receiver.	Check SQUELCH control and connector J2401. Check receiver.
			Turn control clockwise until rushing noise again appears.	Receiver is now unsquelched.	Check SQUELCH control.
STOP	9	SQUELCH control	Turn fully clockwise to OFF position.	Signal or noise continues.	Check SQUELCH switch and control.
	10	VOLUME control	Turn fully counterclockwise to OFF position.	POWER indicator lamp goes out.	Check VOLUME-OFF switch.

Note. Because of similarity in equipment design, the equipment performance checks for Radio Receiving Set AN/VRR–7(*) will be the same as those described above.

CHAPTER 5

THEORY

57. General

a. This chapter will aid the repairman in understanding the operation of Radio Receiving Set AN/FRR–36. Troubleshooting, operation, and servicing will be performed more efficiently if the receiving set theory is understood. The repairman should study the theory information in this technical manual as well as the theory chapters in TM 11–5092 and TM 11–5078. Information on dc power supplies is contained in TM 11–5079.

b. The theory in this manual is limited primarily to the control circuits in Electrical Equipment Cabinet CY–1150/U and their connections to circuits in Radio Receiver R–394/U and Power Supply PP–846/U. Because of similarity in design, the theory discussed in this chapter will be equally applicable to Electrical Equipment Cabinet CY–1223/G and the appropriate dc power supply (contained in the receiver). Only minor modifications, such as different nomenclature designations, will be needed to adapt the theory to the dc receiving set.

58. Power Input Circuit

(fig. 40)

Power from a 115- or 230-volt ac source is connected to terminal board TB2401 in Electrical Equipment Cabinet CY–1150/U. Switch S2401B opens the primary circuit when in the OFF position. This primary power is wired through jack J2401 in the cabinet, P252 and P251 in the receiver base, and J3001 in the ac receiver power supply, Power Supply PP–846/U. Fuse F3001 protects the power supply from circuit overloads.

a. Power transformer T3001 has two primary windings. For 115-volt operation, wire jumpers are connected between the terminals on TB3001 marked 115–1 and 1 and 115–2 and 2. These jumpers connect the two primaries in parallel. For 230-volt operation, the jumpers are removed from terminals 115–1 and 1 and 115–2 and 2, and are connected between the terminals marked 230–1 and 1 and 230–2 and 2. These jumper connections connect the primaries in series.

b. A source of 6.3 volts ac from a secondary winding of transformer T3001 (terminals 12 and 13) is wired through the intercomponent connectors to a green indicator lamp I 2401 on the front panel of Electrical Equipment Cabinet CY–1150/U. Resistor R2407 reduces the lamp voltage, thereby prolonging the life of the lamp. Terminal board TB251 is located in the receiver base.

c. The three power input circuits shown inclosed in broken lines are the dc power input circuits for the 6-, 12-, and 24-volt receiver power supplies (Power Supplies PP–869/U, 868/U, and 867/U, respectively, TM 11–5079). The circuits are similar to the ac power supply input circuit except that the battery voltage is connected to the power supply through a different set of terminals on terminal board TB2401 (fig. 18) in each case. This is done to prevent application of incorrect power to the vibrators and power transformers in the dc power supplies. Fuses F2701, F2801, and F2901 protect their respective power supplies from circuit overloads.

59. B+ Supply Circuits

(fig. 40)

The +145-volt supply is applied to various plate and screen grid circuits in Radio Receiver R–394/U through J3001 (4) in Power Supply PP–846/U and P251 (4) in the receiver base. The +150-volt supply is applied to the plate and screen grid of the squelch clamp tube (V125) in the receiver, and to the screen grid of the audio power amplifier tube (V122) through J3001 (5) and P251 (5). The +160-volt supply is applied to the plate circuit of the audio power amplifier tube (V122) through connectors J3001 (8) and P251 (8). Figure 40 shows only the power connectors in the power supply and receiver. Refer to the schematic diagram of Radio Receiver R–394/U (fig. 33) for the complete circuits. Refer

to TM 11–5092 for the B+ distribution schematic diagram.

60. Filament Supply Circuits
(fig. 40)

The two sources of filament and heater voltages, 1.4 volts dc and 6.3 volts ac also are shown in figure 40. The heater voltage required for the crystal oven assembly (E31) in the LOCAL OSC 152–174 MC plug-in unit also is shown. The +1.4-volt supply is connected from its source in Power Supply PP–846/U to the receiver through J3001 (13) and P251 (13), respectively. The source of 6.3 volts ac for the heaters of tubes V1 and V122 is connected from the power supply to the receiver through J3001 (2) and P251 (2), respectively. This voltage supply also is connected to the crystal oven heater in the receiver through J3001 (9) and P251 (9). These circuits can be examined more thoroughly by referring to the schematic diagram of Radio Receiver R–394/U (fig. 39).

61. Antenna Input Circuit
(fig. 40)

The antenna used with Radio Receiving Set AN/FRR–36 is connected to feed through coaxial connector J2402. This connector is located on the rear cover of the cabinet. Plug P2401 mates with J2402 and feeds the antenna signal to J2401 (A2) through a length of coaxial cable. Connector J2401 mates with the main receiver connector P252. Another length of coaxial cable in the receiver base feeds the signal to J251. Plug P1 is in the RF AMPL 152–174 MC plug-in unit and mates with J251. The antenna cable is terminated at the junction of capacitors C1 and C2 which are part of tuned circuit Z1. Connecting the antenna cable at this junction terminates the antenna transmission line in approximately 52 ohms.

62. Audio Output Circuit
(fig. 40)

a. Audio power is taken from the 8-ohm secondary of the audio output transformer T121. It is then fed through plug P121 in the AUDIO & SQUELCH plug-in unit, then through jack J262 in the receiver base to plug P252, the main receiver connector. This plug mates with jack J2401 in Electrical Equipment Cabinet CY–1150/U and feeds the audio output voltage to speaker LS2401 through the VOLUME control switch S2401A.

b. When S2401A is in the extreme counterclockwise position (OFF), the circuit between the secondary of T121 and loudspeaker LS2401 is open. When the switch is moved one position clockwise, R2406 is connected across terminals 3 and 4 of T121, and R2405 is connected in series with LS2401. R2405 drops the voltage applied to LS2401 and lowers the audio output of the loudspeaker. R2406 is in parallel with the series combination of R2405 and LS2401 to keep the load impedance presented to the secondary of L121 at 8 ohms. In the third and fourth clockwise positions, the resistance placed in series with LS2401 is progressively reduced. This allows increased audio output at the loudspeaker. In the fifth clockwise position, the loudspeaker is connected directly across the secondary of T121 and maximum audio output is obtained. In each case, the load impedance presented to the secondary of T121 is 8 ohms. This provides for optimum operation of the audio amplifier.

63. Squelch Circuit

a. The complete operation of the squelch circuit in Radio Receiver R–394/U requires the use of the SQUELCH control (R2408) and the squelch disable switch (S2402), both of which are located in Electrical Equipment Cabinet CY–1150/U.

b. System connections of the squelch circuit are shown in figure 40. The +145-volt supply is applied to the series connection of R252 in the receiver base and SQUELCH control R2408 through the intercomponent connectors. Adjusting the SQUELCH control varies the positive voltage applied to the control grid of the noise amplifier tube (V123) in the AUDIO & SQUELCH plug-in unit in Radio Receiver R–394/U. Turning R2408 clockwise (sweeping arm moves toward ground) increases this positive voltage, thereby making the squelch circuit less sensitive. Turning R2408 counterclockwise decreases the positive voltage requiring a stronger incoming signal to unsquelch the receiver. Resistors R131, R135, and R136, capacitor C130, and diode CR121 are discussed in TM 11–5092.

c. The +145-volt supply also is applied to the series-connected resistors R142 through R145. The bottom end of this series resistor string is connected to the −40-volt supply in the receiver power supply. When the squelch tube is not conducting, the voltage fed to the grid circuits of the audio tubes (V121 and V122) from the junction

of R144 and R145 is very close to zero. However, when tube V124 is conducting, a large voltage drop across resistor R142 lowers the voltage at this junction to a value of approximately −25 volts. This negative voltage applied through R128 biases the audio tube (V121 and V122) beyond cutoff. R122 is the grid resistor for V121. R127 is a screwdriver-adjusted audio volume control in the AUDIO & SQUELCH plug-in unit.

d. Switch S2402, the squelch disable switch, is ganged to R2408, and is closed when R2408 is turned fully clockwise. Closing switch S2402 places it in the OFF position. This keeps the bias of the audio amplifiers at 0 and prevents the audio tubes from being squelched. Refer to TM 11–5092 for a complete explanation of the squelch circuit.

64. Relay Circuit

a. When a jumper is connected between terminals 9 and 10 on terminal board TB251, the cathode of tube V122 is connected to ground through the intercomponent connectors and R251. When the relay plug-in unit is used in the set, the coil of relay K271 is used in place of R251 as the cathode bias resistance of V122. This is done by connecting the jumper between terminals 10 and 11 on TB251 instead of between terminals 9 and 10. Relay K271, which pulls in when a current of 9 milliamperes (ma) flows through it, is operated when V122 conducts.

b. The squelch circuit of Radio Receiver R–394/U silences the receiver by biasing the control grids of the audio stages beyond cutoff when no signal is being received. When V122 is cut off, K271 is de-energized. C271 and R271 partially bypass the coil of K271 to ground for audio frequencies, thus reducing cathode circuit degeneration.

c. Contacts 6, 7, and 8 of K271 are wired to terminal board TB2401 in Electrical Equipment Cabinet CY–1150/U through the plug-in unit and component connectors. Plug P271 is in the relay plug-in unit and mates with J263 which is directly connected to the main receiver connector P252. Contacts 2 and 4 of relay K271 terminate at plug P252, but are not connected to TB2401 in the cabinet.

d. Contacts 6, 7, and 8 of K271 can be used for controlling an external circuit such as a call signal. When the receiver is squelched or inoperative, terminals 2 and 3 of TB2401 are connected electrically. When the receiver is operating and not squelched, terminals 1 and 2 of TB2401 are connected electrically.

65. Block Diagram of Radio Receiver R–394/U

(fig. 27)

a. The signal path through Radio Receiver R–394/U is shown in figure 23. An fm signal within the frequency band of 152 to 174 mc is amplified by the first and second rf amplifiers (V1 and V2). This signal then is coupled to the first mixer stage (V3) where it beats with a signal from the plug-in unit marked LOCAL OSC 152–174 MC. The signal from this plug-in unit is obtained from a third overtone crystal oscillator (V31), a frequency tripler stage (V32), and a frequency doubler stage (V33). The output frequency of V33 is 7.8 mc below the rf frequency at the first mixer (V3). Consequently the first if. frequency is 7.8 mc.

b. The 7.8-mc if. signal is coupled to a third plug-in unit marked 1ST IF 7.8 MC. V51 amplifies the signal and couples it to second mixer V52. The second hf oscillator stage (V53) injects a 7.345-mc signal into the grid circuit of the second mixer, producing a second if. frequency of 455 kc.

c. The output from the 1ST IF 7.8 MC plug-in unit is passed to a potted (wax-filled) and permanently mounted selectivity filter (Z251). This selectivity filter is resonant to the second if. frequency of 455 kc with a band pass of ±15 kc.

d. The fourth plug-in unit, marked 2ND IF DISCR, contains five 455-kc amplifiers (V81 through V85) and two limiter stages (V86 and V87). Additional amplification of the signal is achieved by these five if. amplifier stages, which are resistance-coupled except for the third 455-kc amplifier which has a plate-tuned load. The two limiter stages remove amplitude variations from the signal which is fed to the discriminator stage. The discriminator stage of this plug-in unit uses two germanium crystal diodes which convert the fm 455-kc if. signal into an audio signal. A negative grid-leak bias voltage is developed at the control grid of the fifth 455-kc if. amplifier (V85) which is proportional to the signal strength of the incoming rf signal. A portion of this bias, referred to as automatic gain control (agc) is connected back to the control grids of the first and second rf amplifiers (V1 and V2) in the RF AMPL 152–174 MC plug-in unit. This bias volt-

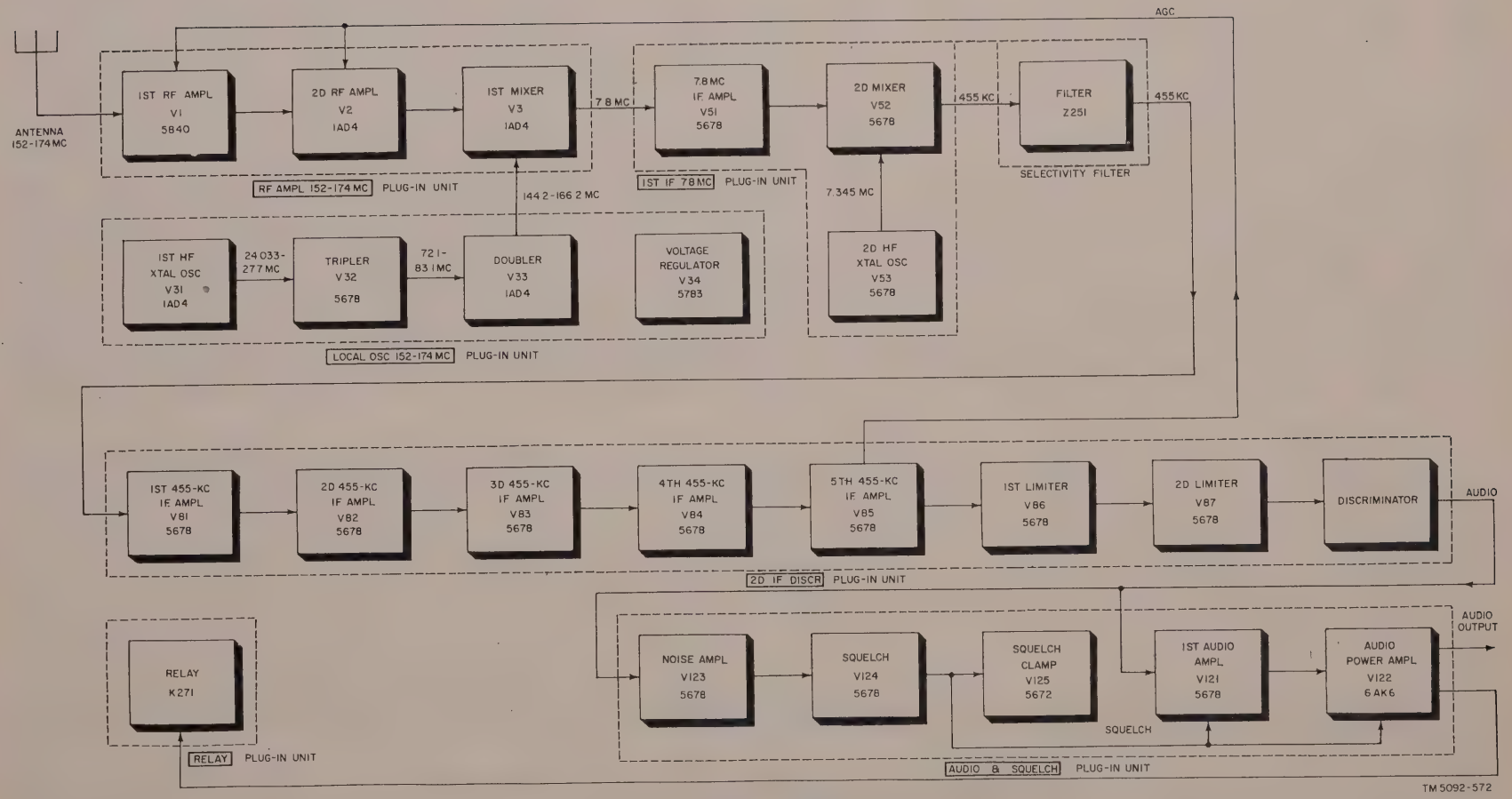


Figure 27. Radio receiver R-394/U, block diagram.

age reduces the gain of these two stages in proportion to the strength of the incoming signal. The age circuit tends to keep the output voltage of the fifth 455-kc amplifier constant despite changes in strength of the received signal.

e. The audio signal delivered by the discriminator is coupled to first audio amplifier V121 in a fifth plug-in unit marked AUDIO & SQUELCH. V121 and V122 amplify the audio signal to a power level sufficient to drive a loudspeaker.

f. The audio output from the discriminator in the 2ND IF DISCR plug-in unit also is fed to the squelch circuit, which is located in the AUDIO & SQUELCH plug-in unit. The audio signal is coupled through a high-pass network, allowing only the higher audio frequencies, which are essentially receiver noise, to reach the control grid of the noise amplifier stage (V123). This stage develops a negative bias when a noise signal is applied to it. The resulting rise in the dc plate voltage of this tube is applied to the grid of squelch tube V124 causing the plate voltage of V124 to drop. The drop in plate voltage of V124 is applied to the grids of audio amplifiers V121 and V122 and biases these tubes beyond cutoff. Squelch clamp tube V125 reinforces the negative biasing action of V124 on the audio amplifier stages.

g. The sixth plug-in unit of the receiver is the RELAY unit. A relay within this unit pulls in when audio power amplifier V122 is drawing plate current and releases when the audio circuits of the receiver are squelched. The contacts of this relay are terminated at the main receiver connector P252 and are used for operating call lights when desired. When Radio Receiver R–394/U is used in a radio set which contains a transmitter, the relay is used for retransmission.

66. Theory of Antenna AT–438/GR

(fig. 16)

The antenna supplied with Radio Receiving Set AN/FRR–36 is a type of ground plane antenna. It is designed to function efficiently over a frequency range of 152 to 174 mc. The characteristics are discussed below.

a. Folded Radiator Section. Folding the radiator section widens the band-pass characteristics of the antenna, thereby giving satisfactory performance over a relatively wide frequency spectrum. The total electrical height of the radiator above the counterpoise is one-fourth wavelength. One end of the folded section is grounded to the mast base. This feature permits grounding of the entire antenna system.

b. Impedance Matching. The other end of the radiator is connected to the center conductor of a 52-ohm coaxial cable through a matching device consisting of a 2-turn coil. The impedance match of the antenna to the transmission line is such that a voltage standing wave ratio is less than 2 to 1 over the entire frequency range of the radio set.

c. Antenna Height. The service area of an antenna system operating at these frequencies theoretically is limited to line-of-sight distances. Consequently, the higher the antenna is installed, the larger will be the service area.

d. Ground Plane. The four horizontal rods on the antenna assembly constitute an artificial ground for the folded vertical radiator. This has the effect of transmitting the rf signal above and over nearby surrounding objects. Likewise, noise pickup below the artificial ground plate is reduced substantially.

CHAPTER 6

FIELD MAINTENANCE

Note. This chapter contains information pertinent to field maintenance. The amount of repair that can be performed by units having maintenance responsibility is limited only by the tools and test equipment available and the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

67. General

This manual contains field maintenance instructions for the cabinets and Antenna AT–438/G. Refer to T M11–5092 when troubleshooting Radio Receiver R–394/U; TM 11–5078 for Power Supply PP–846/U; and TM 11–5079 for Power Supplies PP–867/U, PP–868/U, and PP–869/U.

68. Troubleshooting Techniques

a. General. The first step when servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to a major component responsible for the abnormal operation. The second step, localization, is to localize the fault in the major component to a particular stage or circuit. The third step is called isolation. Isolation means tracing the fault to the particular defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, often can be located by sight, smell, and hearing. The majority of faults in the receiving set must be isolated by checking voltage and resistance.

b. Visual Inspection. The purpose of visual inspection (par. 54) is to locate any visible trouble. Through this inspection the repairman frequently may discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the set which may occur through improper repair methods, and in forestalling future failures.

c. Operational Test. The operational test (par. 74) frequently indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. To use this information fully, all symptoms must be interpreted in relation to one another.

d. Troubleshooting Chart. The possible troubles and corrective measures listed in this chart (par. 75) will aid greatly in localizing trouble.

e. Intermittents. In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set.

69. System Sectionalization of Trouble to a Component

System sectionalization of Radio Receiving Set AN/FRR–36 or AN/VRR–7(*) consists of determining whether the trouble is in the receiver, power supply, cabinet, antenna, or in the power source.

a. Operate the radio receiving set and observe its performance. See the equipment performance check list (par. 56) for normal indications.

b. If another receiver, power supply, or antenna is available, substitute it for the original component. This test should indicate the defective component.

c. Check the connectors between the various components. The trouble may be in one of the cabinet connectors.

d. If the defective component is the receiver or the power supply, refer to the applicable manual for that component for further trouble-shooting information.

70. Troubleshooting Data

Take advantage of the material supplied in this manual. Consult the following trouble-shooting data:

Fig.	Par.	Description
18		Radio Receiving Set AN/FRR–36, front panel terminal board.
20		Radio Receiver R–394/U, test points.
22		Radio Receiver, LOCAL OSC 152–174 MC plug-in unit, test and alinement points.
23		Radio Receiver R–394/U RF AMPL 152–174 MC plug-in unit, frequency changing alinement points.
30		Radio Receiving Set AN/FRR–36, front cover removed showing replaceable parts.
31		Resistor color codes.
32		Capacitor color codes.
33		Radio Receiver R–394/U, schematic diagram.
34		Electrical Equipment Cabinet CY–1150/U, schematic diagram.
35		Power Supply PP–846/U, schematic diagram.
36		Power Supply PP–867/U, schematic diagram.
37		Power Supply PP–867/U, schematic diagram (first 56 units Order No. 11661–Phila–52).
38		Power Supply PP–868/U, schematic diagram.
39		Power Supply PP–869/U, schematic diagram.
40		Radio Receiving Set AN/FRR–36, interconnecting and control circuits.
	74	Operational Test.
	75	Troubleshooting chart.
	76	Resistance measurements on Electrical Equipment Cabinet CY–1150/U.

Note. For additional troubleshooting information, refer to TM 11–5078, TM 11–5079, and TM 11–5092.

71. Test Equipment for Troubleshooting

The following test equipment is required for troubleshooting Radio Receiving Set AN/FRR–36 or AN/VRR–7(*):

Item	Technical manual
Signal Generator TS–497A/URR	TM 11–5030.
Electronic Multimeter TS–505/U	TM 11–5511.
Multimeter TS–352/U	TM 11–5527.

72. Use of Electrical Special Purpose Cable Assembly CX–2371/U

(figs. 28 and 29)

This patch cord is available for connecting Radio Receiver R–394/U to either Electrical Equipment Cabinet CY–1150/U or CY–1223/G when it is desired to operate the receiver out of the cabinet. This feature enables the repairman to troubleshoot or aline the receiver when such action is required. The patch cord is connected between J2401 in Electrical Equipment Cabinet CY–1150/U and P252 in the receiver; an identical connection can be made between the equivalent terminal board of Electrical Equipment Cabinet CY–1223/G and P252 when checking the AN/VRR–7(*). Authorization to issue this patch cord is contained in SB 11–170.

73. General Precautions

When servicing the radio receiving set, observe the following precautions:

a. Do not make any repairs or adjustments inside the cabinet without first removing power from the set. Terminal board TB2401 of CY–1150/U carries 115 volts or 230 volts ac. An

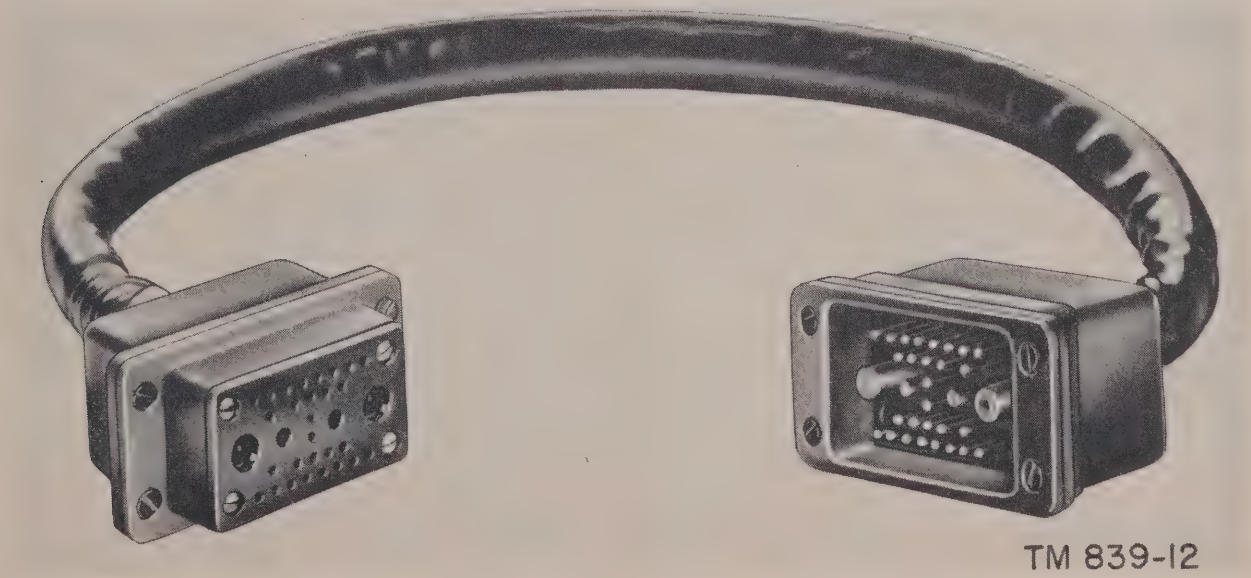


Figure 28. Electrical special purpose cable assembly CX–2371/U.

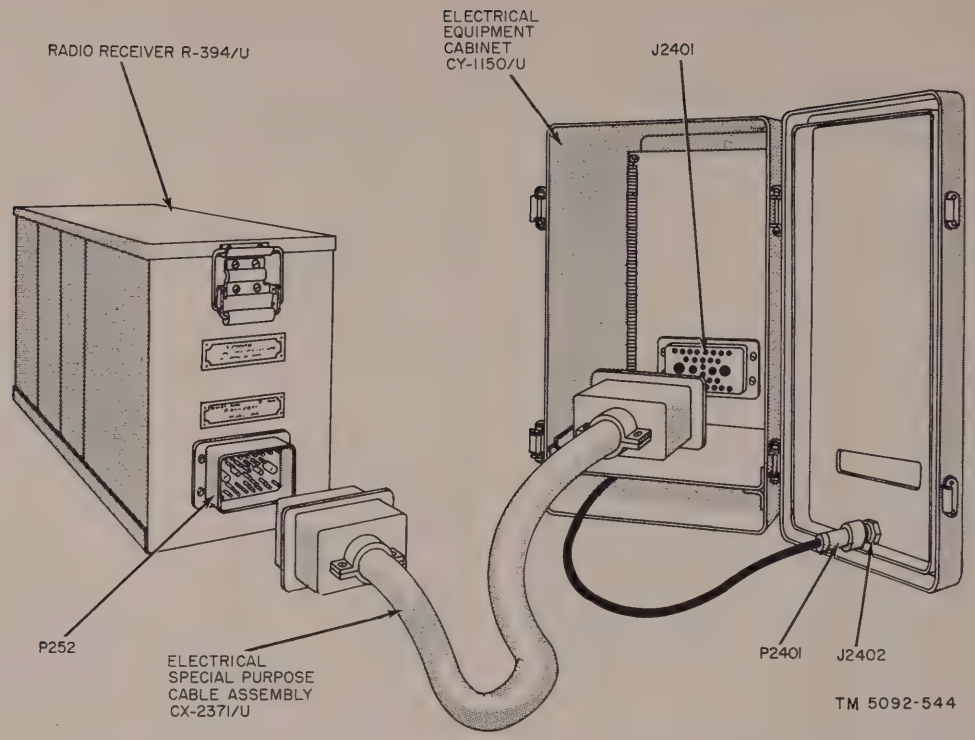


Figure 29. Patch cord connections between radio receiver R–394/U and electrical equipment cabinet CY–1150/U.

equivalent terminal board on CY–1223/G will carry either 6, 12, or 24 volts.

b. Be careful not to damage wires and cables if it is necessary to move or disconnect them from the terminal board or from one of the controls on the front cover.

c. When performing any soldering on the radio set, be sure the soldering job is a good one. Clean up any solder that may accidentally fall into the cabinet. A poor soldering job often leads to future troubles.

74. Operational Test for Radio Receiving Set AN/FRR–36

Turn the VOLUME control clockwise two to three positions. The POWER indicator lamp should light. Set the SQUELCH control at OFF. Allow the tubes in Radio Receiver R–394/U approximately 20 or 30 seconds to warm up. If a signal is being received on the receiver frequency, it should be audible. In the absence of a signal, a rushing noise should be heard. Turn the VOLUME control to each of the four volume levels while observing the relative volume. Set it for a comfortable volume level. If no signal is being received, turn the SQUELCH control counterclockwise slowly until the rushing noise stops. The receiver now is squelched. Turn the SQUELCH control clockwise. The rushing noise should once again be heard. Turn the SQUELCH control fully clockwise to the OFF position. To turn power off, turn the VOLUME control fully counterclockwise to the OFF position.

Note. Operational tests for Radio Receiving Set AN/VRR–7(*) will be similar to the ac receiving set.

75. Troubleshooting Chart for Radio Receiving Set AN/FRR–36

a. The following chart is supplied as an aid in locating trouble in the radio receiving set. This chart lists symptoms, probable troubles, and corrections. In cases where the probable trouble exists in Radio Receiver R–394/U or Power Supply PP–846/U, reference is made to the applicable technical manual.

Symptom	Probable trouble	Correction
1. Radio set completely dead and indicator lamp on radio receiving set does not light.	Power cord not connected to TB2401	Connect to TB2401 (fig. 17 and 18).
	Defective fuse F3001 in receiver power supply (fig. 19).	Replace fuse (fig. 19).
	Switch S2401 defective (fig. 30)	Replace switch.
	Defective terminals 4, 5, and 6 of TB2401 and terminals 3, 4, and 5 of J2401 (figs. 18 and 34).	Check with ohmmeter. Replace or repair board or connector if necessary.
	Defective Radio Receiver R–394/U	Refer to TM 11–5092.
	Defective power supply	Refer to TM 11–5078.
2. Receiver operates but no audio signal is heard.	Defective loudspeaker LS2401 (fig. 30)	Replace loudspeaker.
	Defective connections 14 and 15 on J2401 (fig. 30).	Repair connections.
3. Receiver operates, but signals are very weak.	Defective antenna connections to cabinet.	Repair connection between Cord CG–399A/U and J2402 (fig. 17).
		Repair connection A2 on J2401 (fig. 34).
	Defective Cord CG–399A/U	Replace CG–399A/U.
	Defective receiver	Refer to TM 11–5092.
4. Audio signal from loudspeaker distorted on all positions of VOLUME control.	Defective LS2401	Replace LS2401.
	Defective speaker connections through VOLUME control or at terminals 14 and 15 of J2401 (fig. 30).	Repair or replace connections or connector.
	Defective Radio Receiver R–394/U.	Refer to TM 11–5092.
5. Receiving set will not squelch	SQUELCH control or squelch disable switch defective.	Replace.
	Trouble in receiver	Refer to TM 11–5092.
6. Receiving set operates, but POWER indicator lamp does not light.	Lamp I 2401 or resistor R2407 defective (fig. 30).	Replace.
7. Hum or noise in radio set audio signal.	Defective receiver	Refer to TM 11–5092.
	Defective power supply	Refer to TM 11–5078.
8. When the RELAY plug-in unit in Radio Receiver R–394/U is used, it does not operate. Reception is normal.	Defective relay plug-in unit or relay	Refer to TM 11–5092.
	Defective connections 27, 28, and 29 on J2401.	Repair connections.

b. Radio Receiving Set AN/VRR–7(*). Radio Receiving Set AN/VRR–7(*) may be checked by applying the chart in *a* above. Nomenclature designations may or may not vary for the AN/VRR–7(*).

76. Resistance Measurements on Electrical Equipment Cabinet CY–1150/U

(fig. 34)

a. Remove the receiver from the cabinet and place the controls in the positions as indicated in chart in *b* below.

b. The following chart affords ready check on the comopents and general wiring of the cabinet.

Resistance measurement and continuity check start

Operation	Location of ohmmeter test leads	Name and position of control	Normal resistance measurement (ohms)
1	Terminals 14 and 15 on J2401	VOLUME control S2401A at OFF (extreme counterclockwise).	Infinite
2	Terminals 14 and 15 on J2401	VOLUME control S2401A at first position, (one position clockwise from OFF).	8. 7
3	Terminals 14 and 15 on J2401	VOLUME control S2401A at second position	8
4	Terminals 14 and 15 on J2401	VOLUME control S2401A at third position	7. 8
5	Terminals 14 and 15 on J2401	VOLUME control S2401A at fourth position (extreme clockwise).	7
6	Terminals 6 and ground on J2401	None	23. 7
7	Terminals 8 and ground on J2401	SQUELCH control S2402 at OFF position (extreme clockwise).	500 K
8	Terminals 8 and ground on J2401	SQUELCH control S2402 in extreme counterclockwise position.	Zero
9	Terminals 9 and ground on J2401	SQUELCH control S2402 at OFF position	Zero
10	Terminals 9 and ground on J2401	SQUELCH control S2402 in extreme counterclockwise position.	Infinite

Section II. REPAIRS

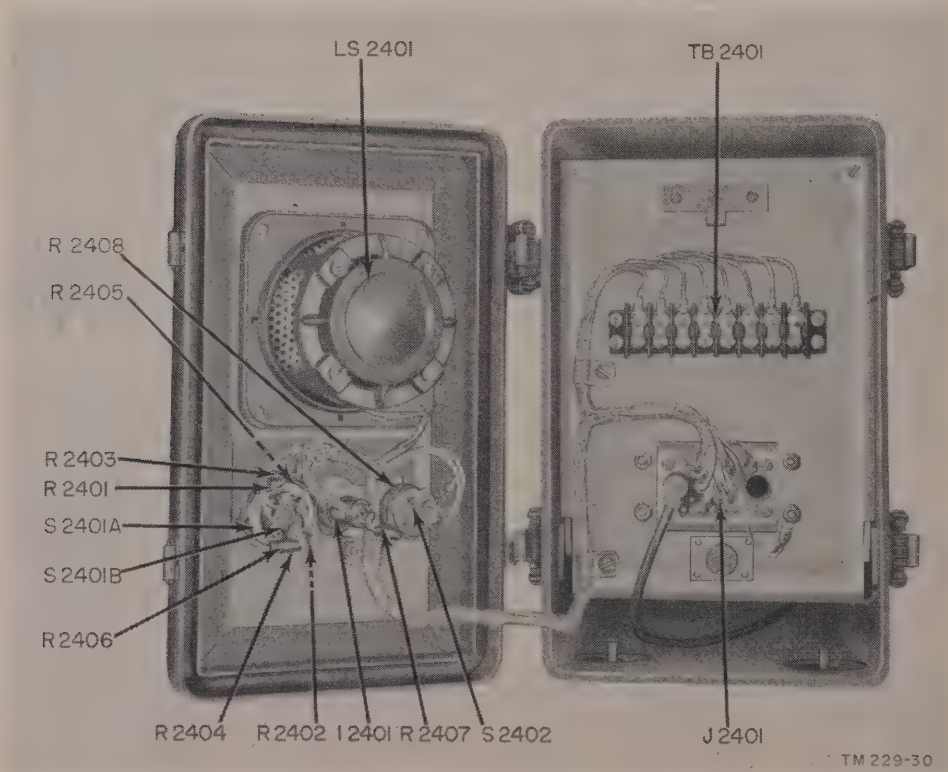


Figure 30. Radio receiving set AN/FRR–36, front cover removed showing replaceable parts.

77. Replacement of Parts

(fig. 30)

a. There are few parts to be disassembled in either Radio Receiving Set AN/FRR–36 or AN/VRR–7(*). Most of the parts that require replacement are fastened with threaded fasteners.

b. Radio Receiver R–394/U is removed by opening the rear cover of the electrical equipment cabinet and turning the lock-in rod counterclockwise. The receiver is then withdrawn by pulling it out of the cabinet. The handle on the receiver provides a firm hold on the receiver.

c. For detailed information on the repair of the receiver, refer to TM 11–5092.

d. To physically locate parts in Electrical Equipment Cabinet CY–1150/U, refer to figure 30. (Electrical Equipment Cabinet CY–1223/G is similar in design.)

e. When soldering becomes necessary, observe the following precautions:

(1) Before a part is unsoldered, note the position of the leads. If the part has a number of connections, tag each of the leads to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set; they may cause short circuits.

(4) Make well-soldered joints, since a poorly soldered joint causes faulty operation and is very difficult to find.

78. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are contained in TM 9–2851. Refer to these instructions as necessary.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

79. Disassembly

The following instructions are furnished as a guide for preparing the radio set for transportation and storage.

a. Disconnect the power cord from the radio receiving set and form into coil.

b. Disconnect the coaxial antenna cable from the receiving set and form into a coil.

c. Remove the antenna from its support, disassemble it, and pack it in the manner received (pars. 23 and 24).

d. Roll and pack the antenna cable and power cord.

80. Repacking for Shipment and Limited Storage

The exact procedure for repacking depends on the material available and the conditions under which the equipment is to be shipped or stored. Use the procedures indicated below whenever possible. The information concerning the original packaging (par. 9 and figs. 12 and 13) will also be helpful.

a. Material Requirements.

(1) The following materials are required for packaging either Radio Receiving Set AN/FRR–36 or AN/VRR–7 (*):

Material	Quantity
Waterproof barrier material	17.5 sq ft.
Paper, single-faced, flexible, corrugated	29 sq ft.
Tabe, pressure sensitive	24 sq ft.
Tape, paper, gummed	34 sq ft.
Strapping, flat steel	19 ft.
Wooden shipping boxes*	3.

*Only two shipping boxes will be needed in packing the AN/VRR–7(*).

(2) Detailed dimensional data for the three wooden boxes are as follows:

Box No.	Contents	Box size (in.)	Board ft	Cubic ft	Packed weight (lb)
1 of 3	Receiver in cabinet	21½ x 9½ x 12½	12	2. 52	68. 5
2 of 3	Antenna	30 x 12½ x 5½	11. 9	1. 97	80
3 of 3	Antenna mast*	66 x 3 x 3	3. 2	. 36	

*The antenna mast is not included with the AN/VRR–7(*). Only two boxes are required to pack the AN/VRR–7(*).

b. Packaging Radio Receiving Set.

(1) Cushion the radio receiving set (receiver in the cabinet) on all surfaces with pads of fabricated or flexible single-faced corrugated paper. Secure the wrap with gummed tape. If possible, place the entire wrap in the original carton.

(2) Small miscellaneous items such as coil assemblies, running spares, etc. must be carefully wrapped. Wind each cable assembly into a coil of convenient size and tie with cotton tape. Use cellulose wadding or flexible single-faced corrugated paper to cushion each item as required. Consolidate the miscellaneous items within a wrap of flexible single-faced corrugated paper. Then, if possible, place the entire wrap in the original carton.

(3) Inclose each technical manual within a close-fitting bag fabricated of waterproof barrier material. Seal seams with water-resistant, pressure-sensitive tape.

c. Packaging Antenna. Package the antenna and its miscellaneous components; use the techniques given in *a* and *b* above.

d. Packaging Antenna Mast. Package the antenna mast by wrapping with single-faced corrugated paper. Seal the wrap with gummed tape.

e. Packing Receiving Set, Antenna, and Antenna Mast. Use three separate wooden boxes for the receiving set, antenna, and antenna mast. The wooden boxes for the receiving set and the antenna must be fitted with a waterproof case liner (the original if saved). Insert all consolidated packages into wooden boxes. Wooden boxes must be fabricated to fit the contents snugly. All voids must be filled with pads of flexible corrugated paper. Securely nail down the lids of all boxes. Use metal strapping around boxes intended for intertheater shipment.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

81. General

The demolition procedure in paragraph 82 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

82. Methods of Destruction

a. Smash. Smash tubes, coils, and capacitors; use sledges, axes, handaxes, pickaxes, hammers, crowbars or heavy tools.

b. Cut. Cut cords and wiring; use axes, handaxes, and machetes.

c. Burn. Burn cords, resistors, capacitors, coils, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

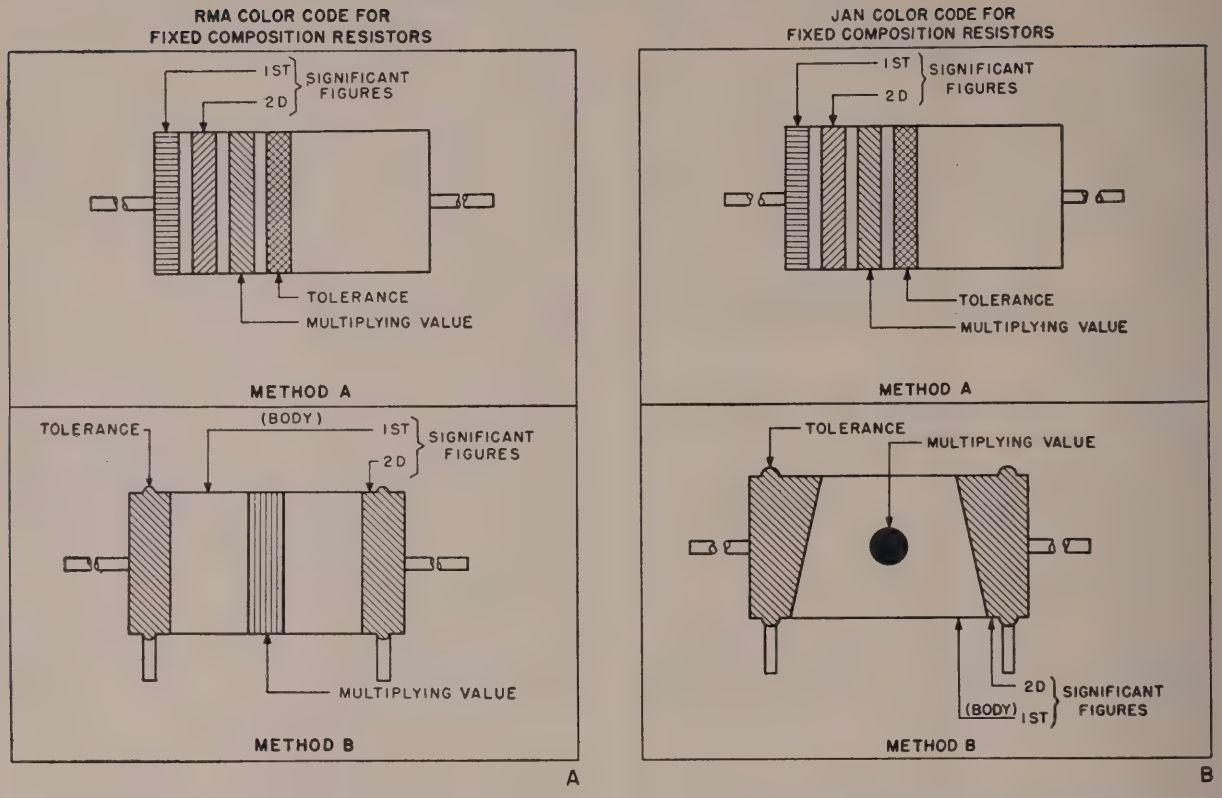
d. Bend. Bend panels and chassis.

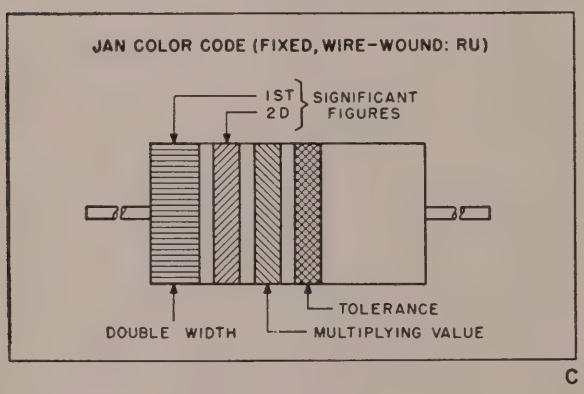
e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

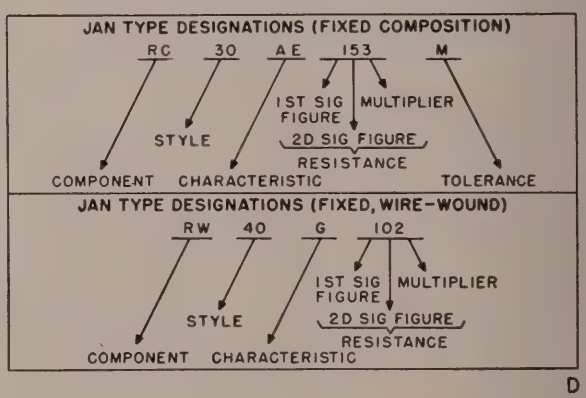
f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into the streams.

g. Destruction. Destroy everything.

RESISTOR COLOR AND LETTER CODE







STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	–	–
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	–
YELLOW	4	10,000	± 4	–
GREEN	5	100,000	± 5	–
BLUE	6	1,000,000	± 6	–
VIOLET	7	10,000,000	± 7	–
GRAY	8	100,000,000	± 8	–
WHITE	9	1,000,000,000	± 9	–
GOLD	–	0.1	± 5	J
SILVER	–	0.01	±10	K
NO COLOR	–	–	±20	M

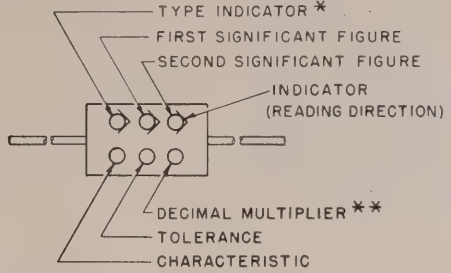
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

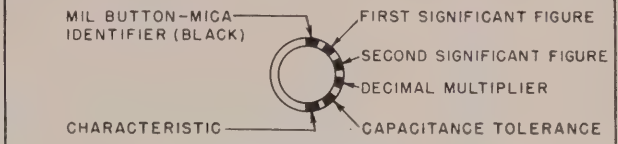
Figure 31. Resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)

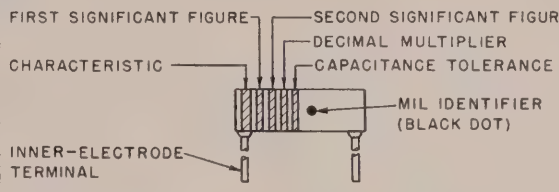


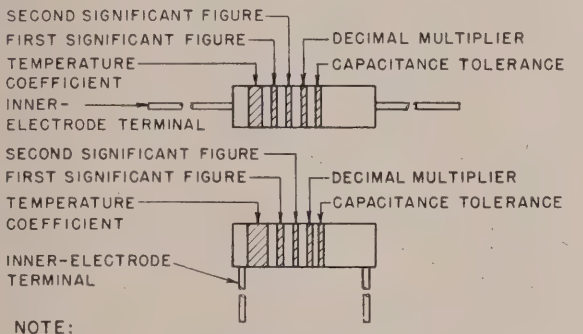
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
** INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)



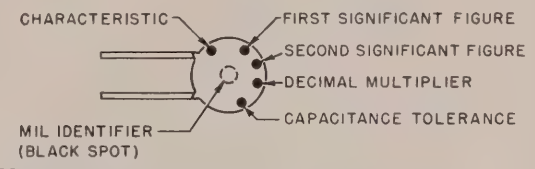
BUTTON-MICA (CB)





NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 32. Capacitor color codes.

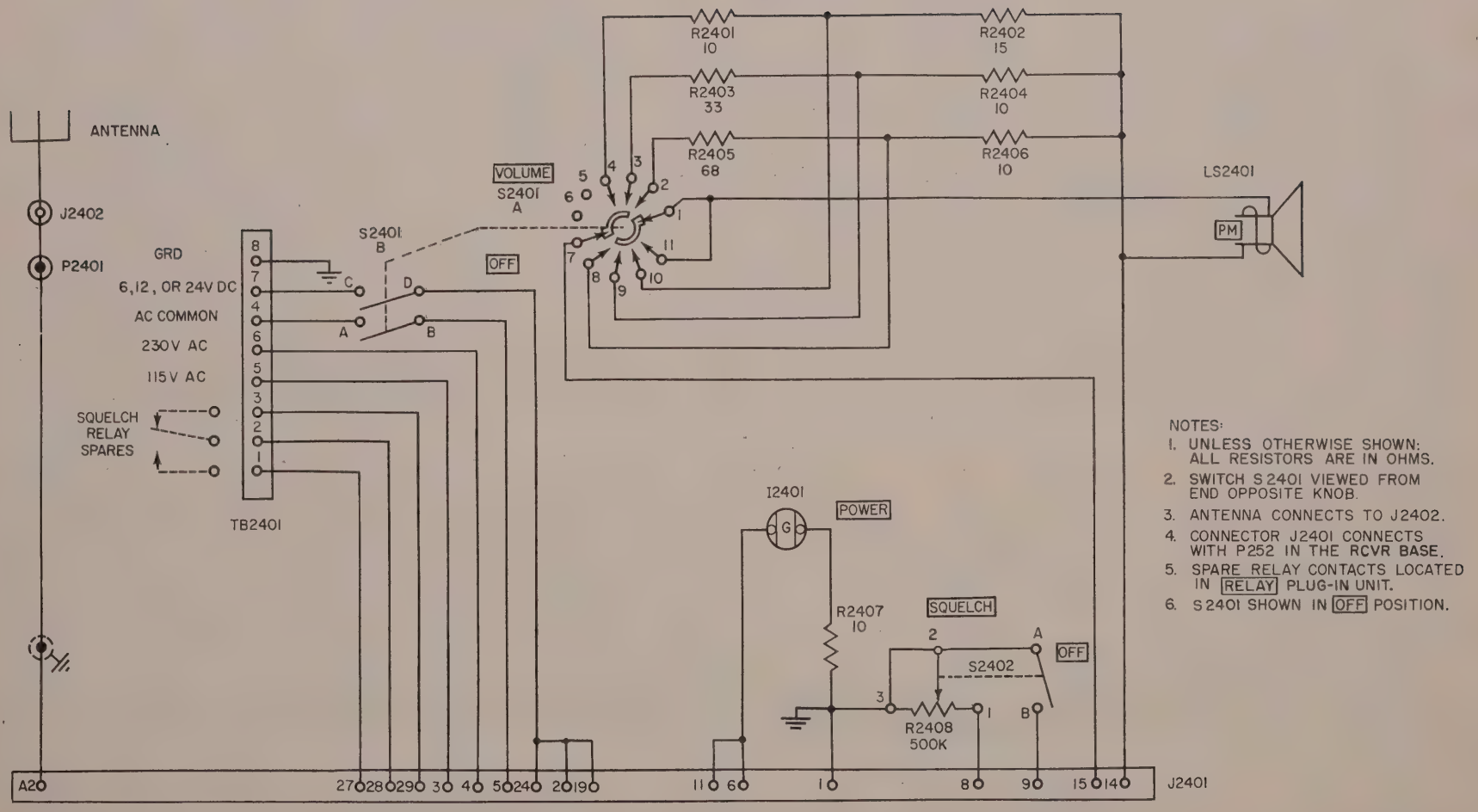
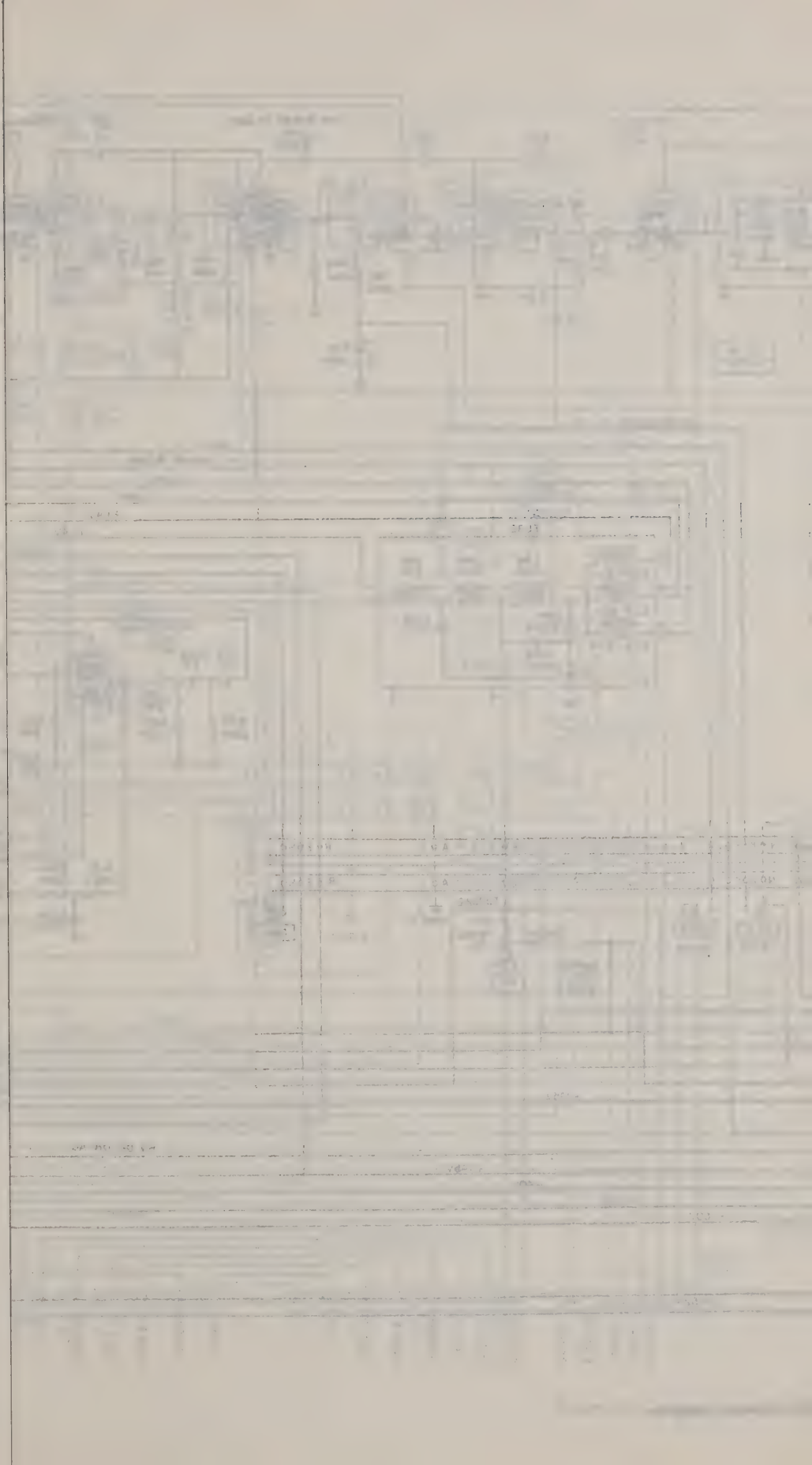
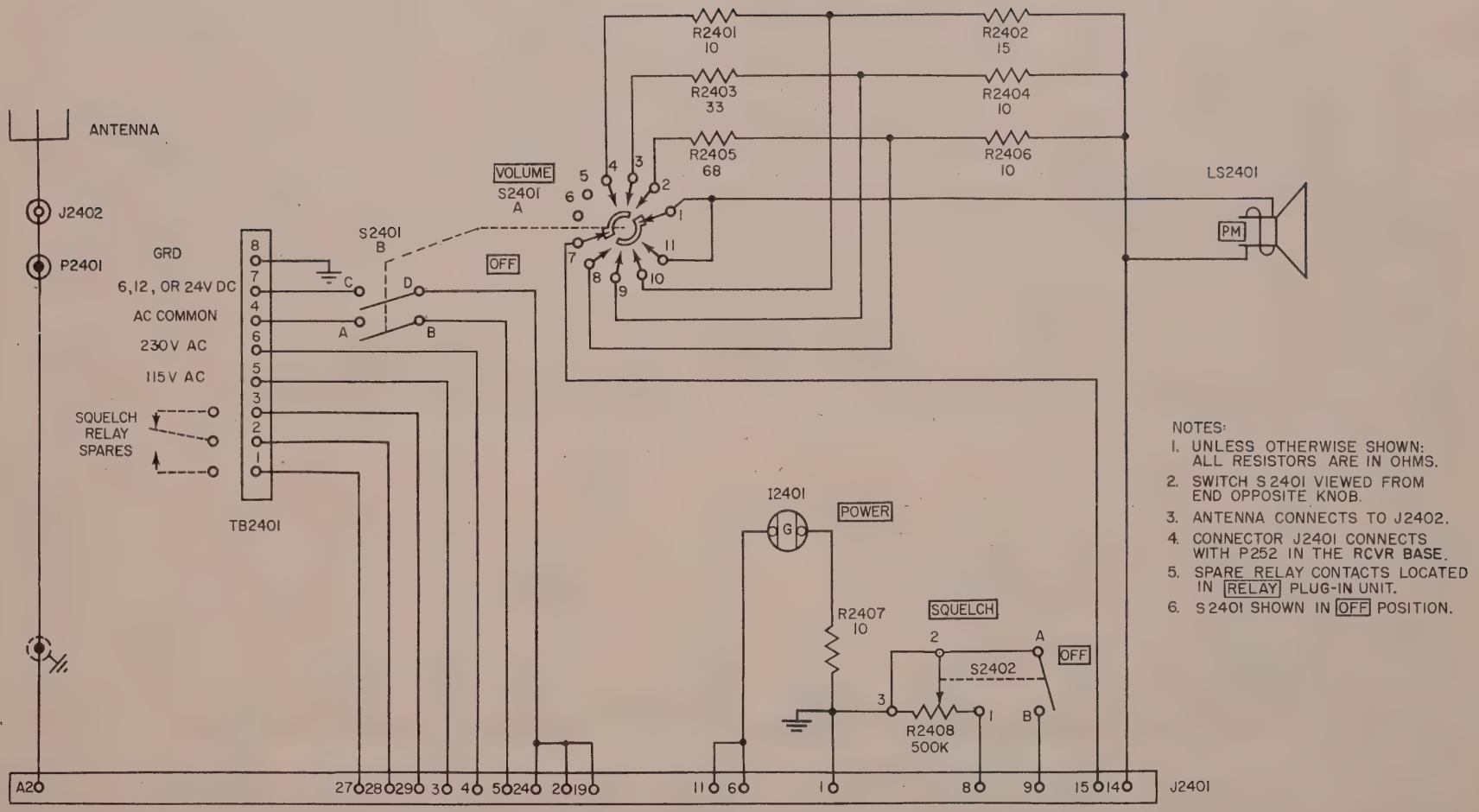


Figure 34. Electrical equipment cabinet CY–1150/U, schematic diagram.

L

A2
P252





NOTES:
1. UNLESS OTHERWISE SHOWN: ALL RESISTORS ARE IN OHMS.
2. SWITCH S2401 VIEWED FROM END OPPOSITE KNOB.
3. ANTENNA CONNECTS TO J2402.
4. CONNECTOR J2401 CONNECTS WITH P252 IN THE RCVR BASE.
5. SPARE RELAY CONTACTS LOCATED IN [RELAY] PLUG-IN UNIT.
6. S2401 SHOWN IN [OFF] POSITION.

TM 229-25

Figure 34. Electrical equipment cabinet CY-1150/U, schematic diagram.

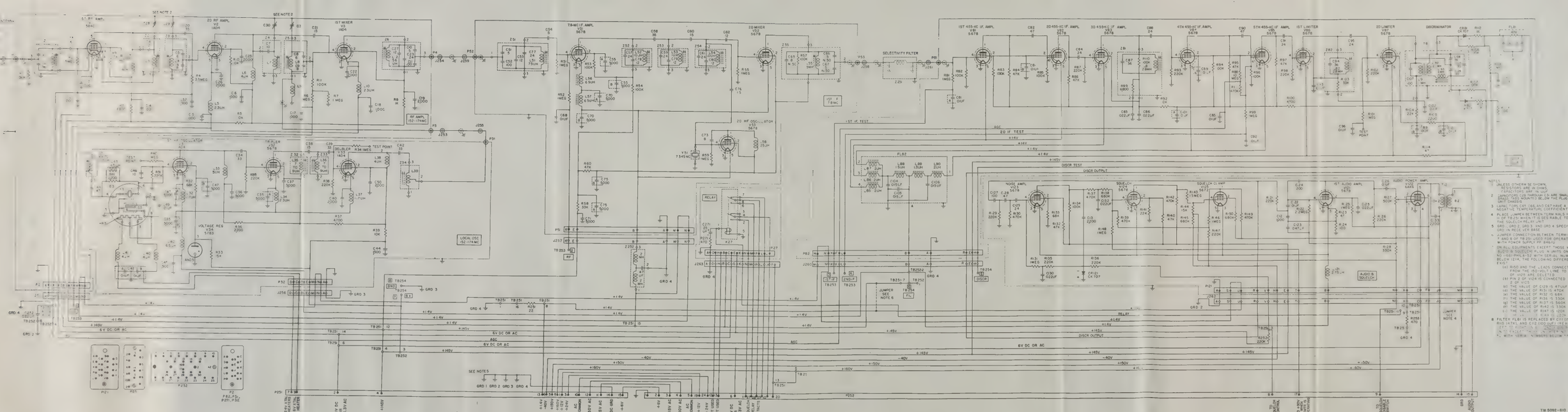
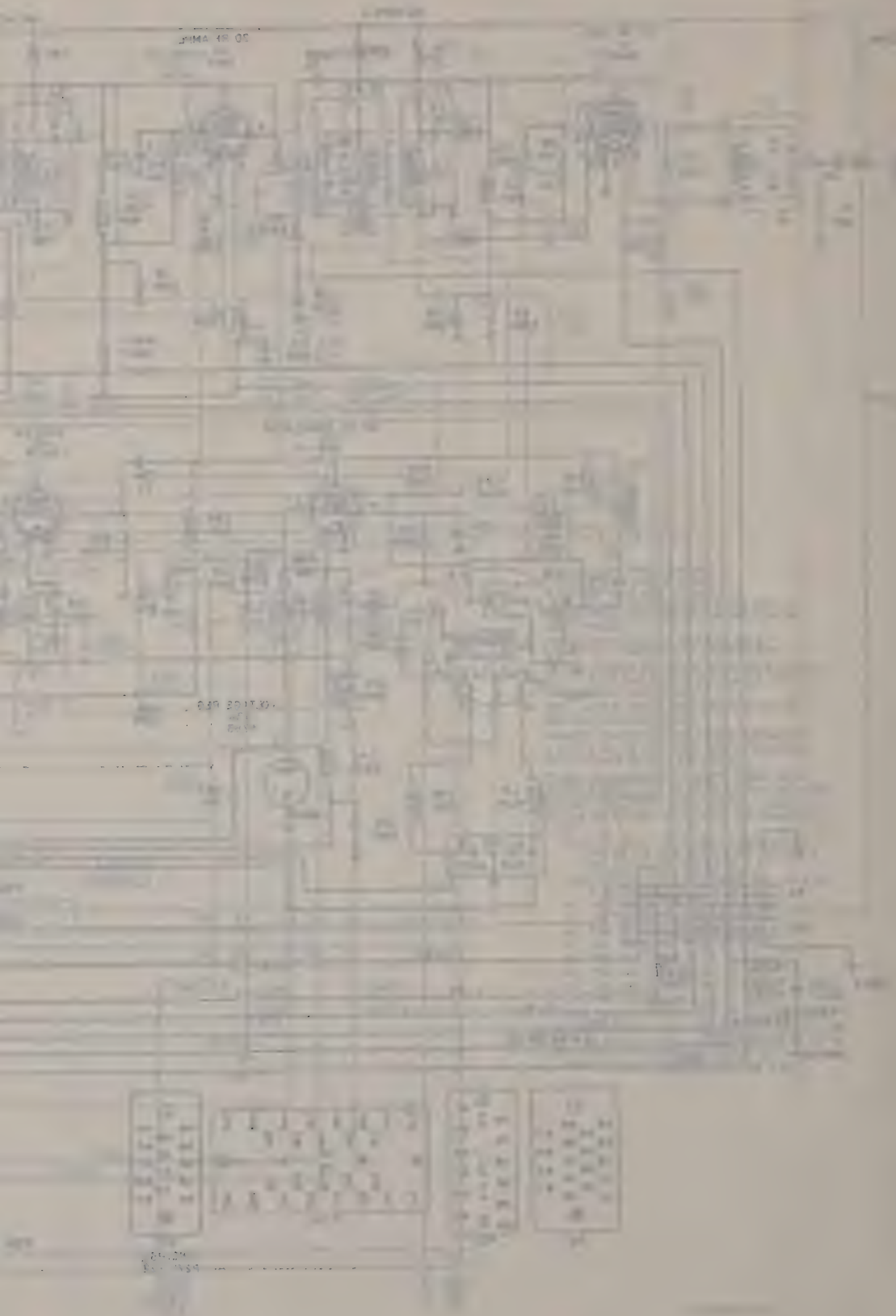
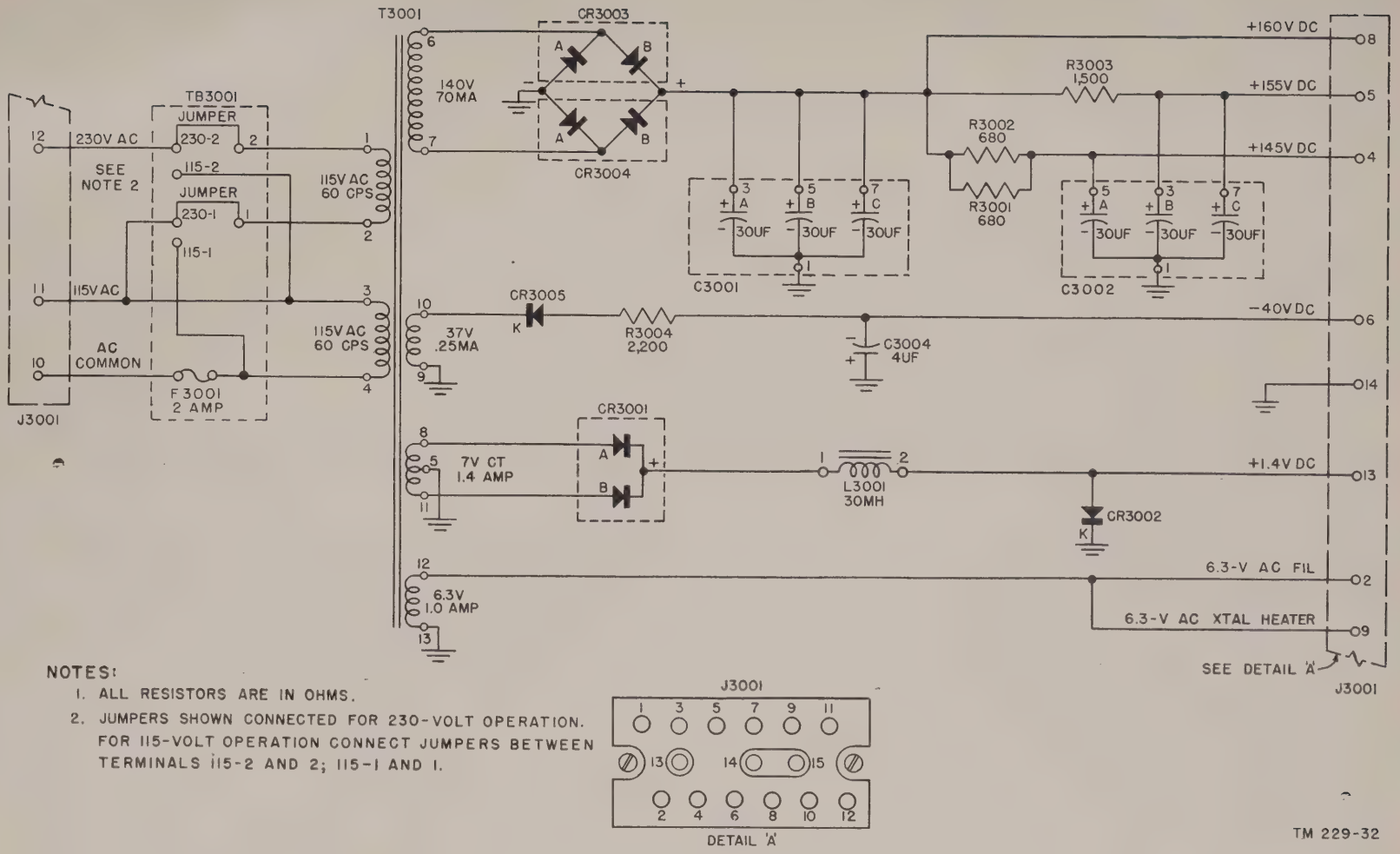


Figure 33. Radio receiver R-894/U, schematic diagram.





NOTES:

1. ALL RESISTORS ARE IN OHMS.
2. JUMPERS SHOWN CONNECTED FOR 230-VOLT OPERATION. FOR 115-VOLT OPERATION CONNECT JUMPERS BETWEEN TERMINALS 115-2 AND 2; 115-1 AND 1.

TM 229-32

Figure 35. Power supply PP-846/U; schematic diagram.

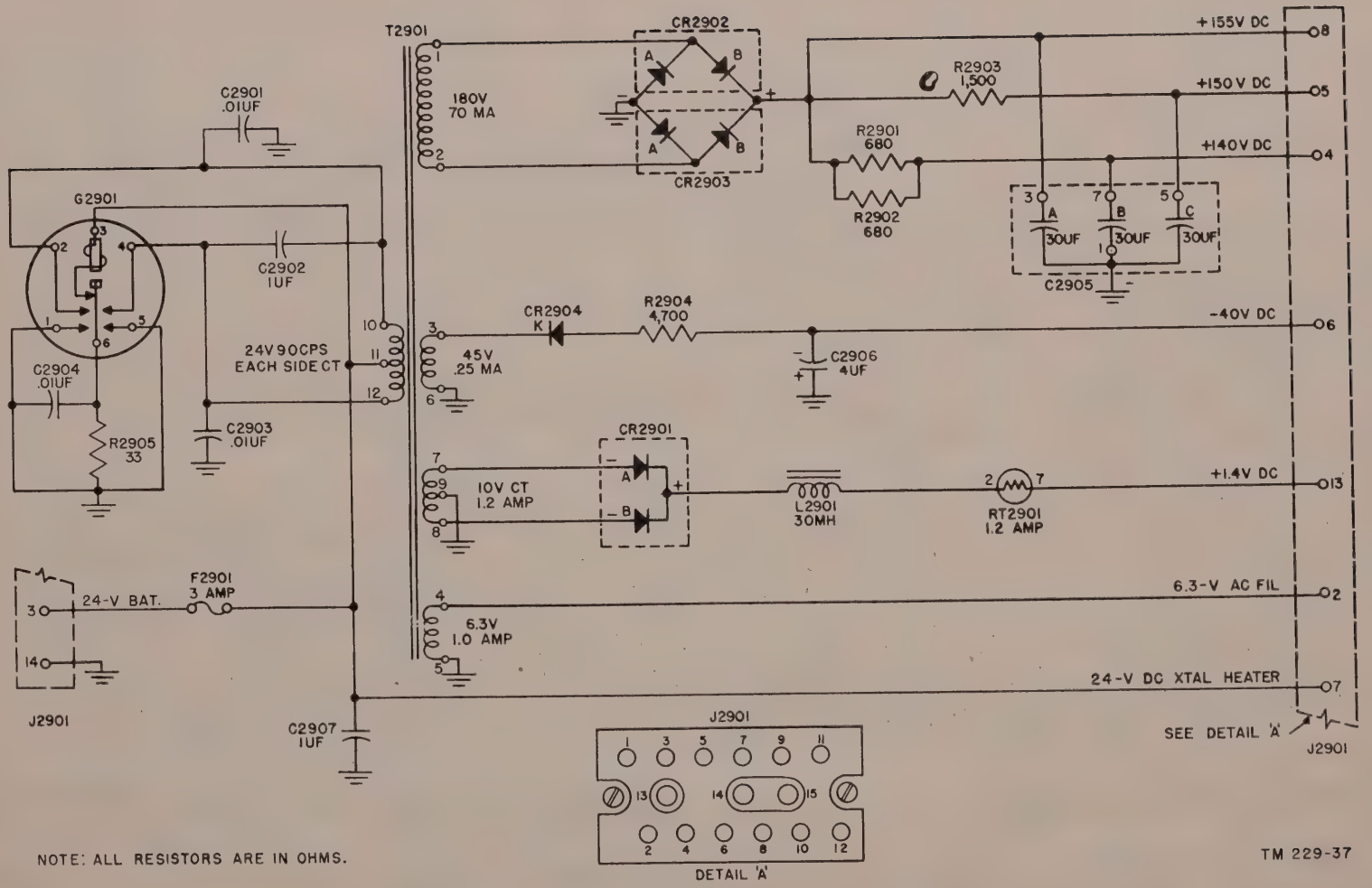


Figure 36. Power supply PP-867/U, schematic diagram.

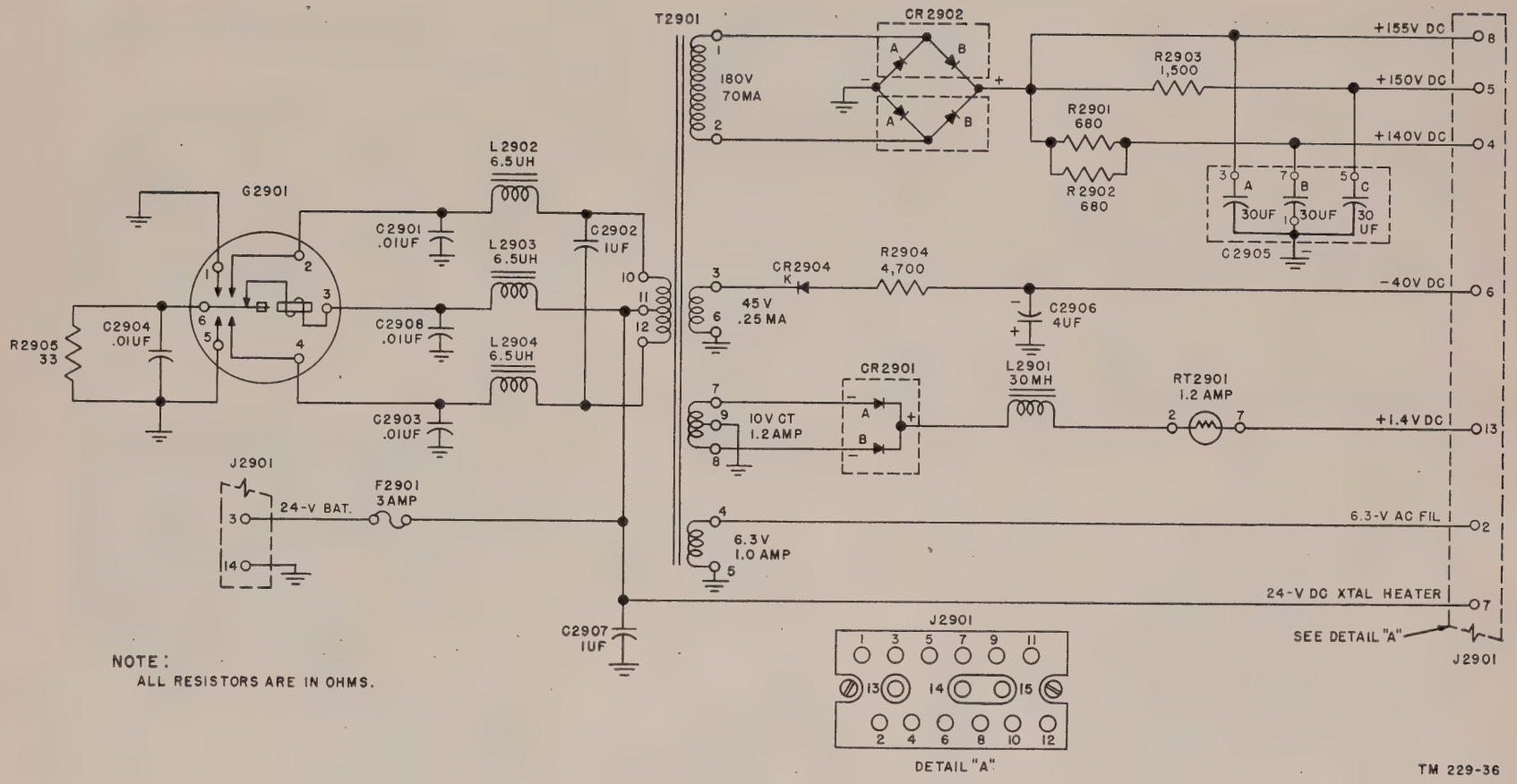


Figure 37. Power supply PP–867/U, schematic diagram (first 56 units on Order No. 11661–Phila–52).

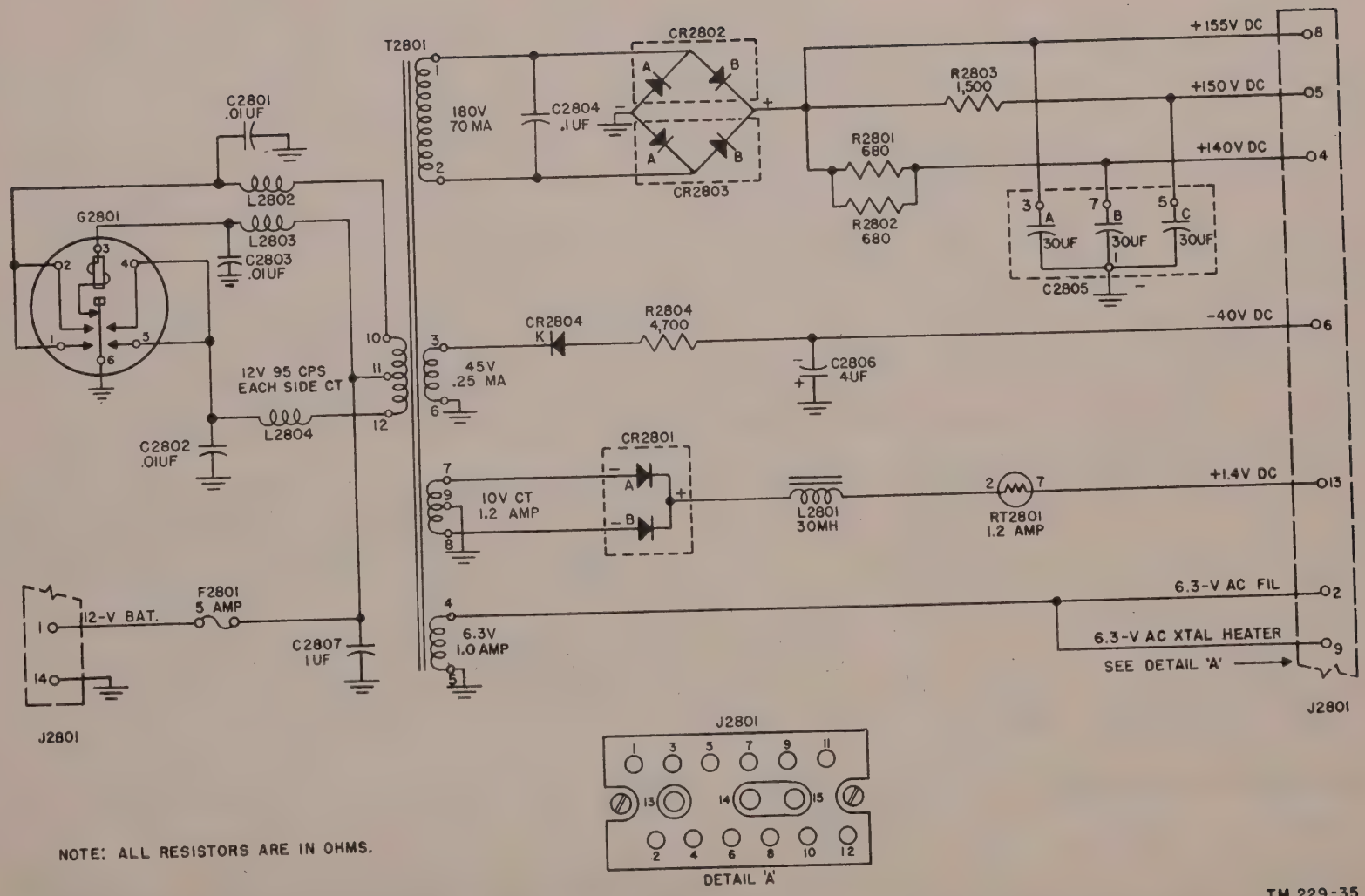
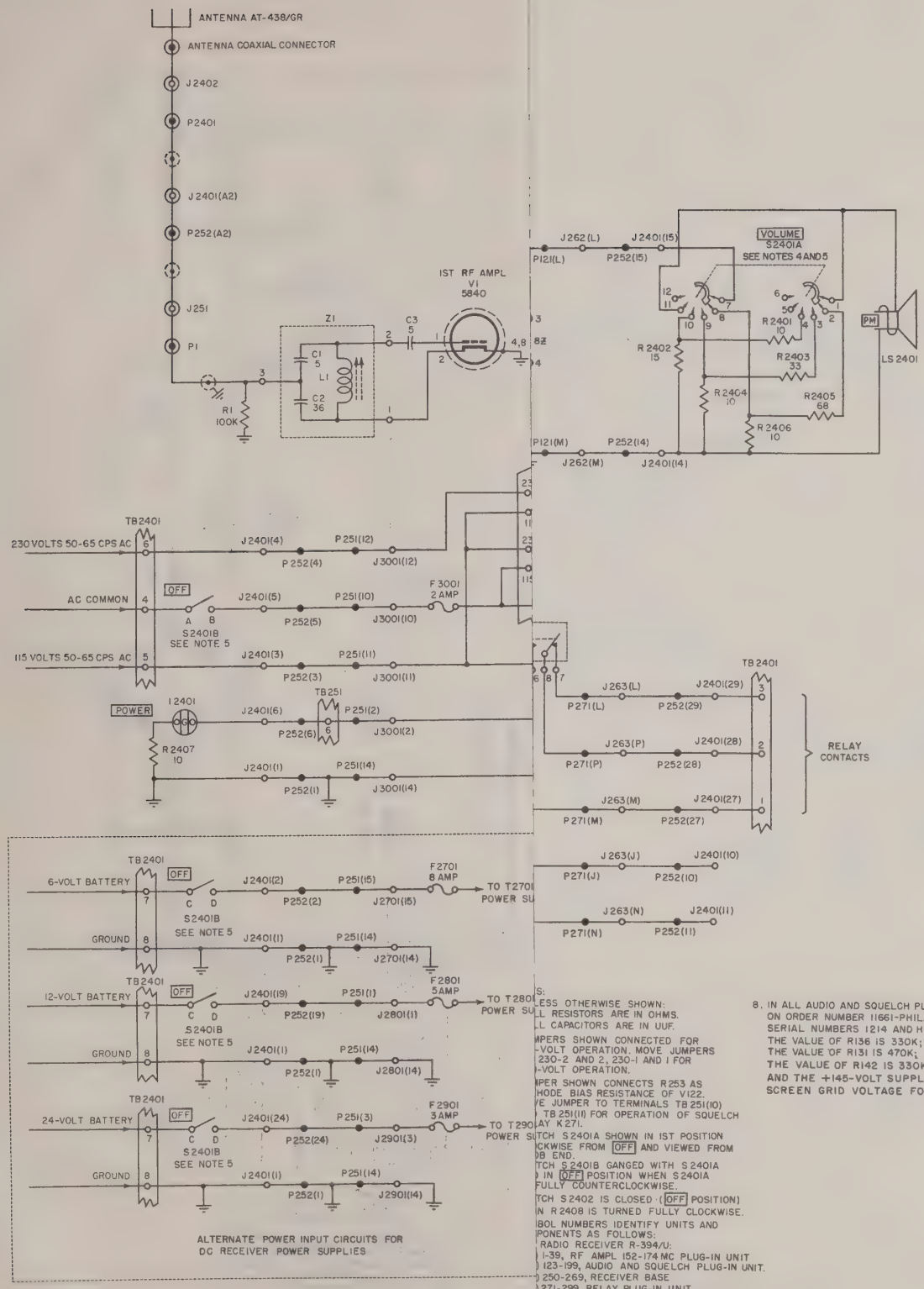


Figure 38. Power supply PP 868/U, schematic diagram.



S:

LESS OTHERWISE SHOWN:
LL RESISTORS ARE IN OHMS.
LL CAPACITORS ARE IN UUF.

MPERS SHOWN CONNECTED FOR
-VOLT OPERATION. MOVE JUMPERS
230-2 AND 2, 230-1 AND 1 FOR
-VOLT OPERATION.

MPER SHOWN CONNECTS R253 AS
HODE BIAS RESISTANCE OF V122.
E JUMPER TO TERMINALS TB251(10)
TB251(11) FOR OPERATION OF SQUELCH
AY K271.

TCH S2401A SHOWN IN 1ST POSITION
CKWISE FROM OFF AND VIEWED FROM
B END.

TCH S2401B GANGED WITH S2401A
IN OFF POSITION WHEN S2401A
FULLY COUNTERCLOCKWISE.

TCH S2402 IS CLOSED (OFF POSITION)
N R2408 IS TURNED FULLY CLOCKWISE.

BOL NUMBERS IDENTIFY UNITS AND
PONENTS AS FOLLOWS:
RADIO RECEIVER R-394/U:
I-39, RF AMPL. 152-174 MC PLUG-IN UNIT
) 123-199, AUDIO AND SQUELCH PLUG-IN UNIT.
) 250-269, RECEIVER BASE
) 271-299, RELAY PLUG-IN UNIT
)I-2499, ELECTRICAL EQUIPMENT CABINET CY-1150/U.
)I-2799, POWER SUPPLY PP-869/U
)I-2899, POWER SUPPLY PP-868/U
)I-2999, POWER SUPPLY PP-867/U
)I-3099, POWER SUPPLY PP-846/U

8. IN ALL AUDIO AND SQUELCH PLUG-IN UNITS ON ORDER NUMBER 11661-PHILA-52 BEARING SERIAL NUMBERS 1214 AND HIGHER:
THE VALUE OF R136 IS 330K;
THE VALUE OF R131 IS 470K;
THE VALUE OF R142 IS 330K;
AND THE +145-VOLT SUPPLY FURNISHES SCREEN GRID VOLTAGE FOR V125.

TM 229-38

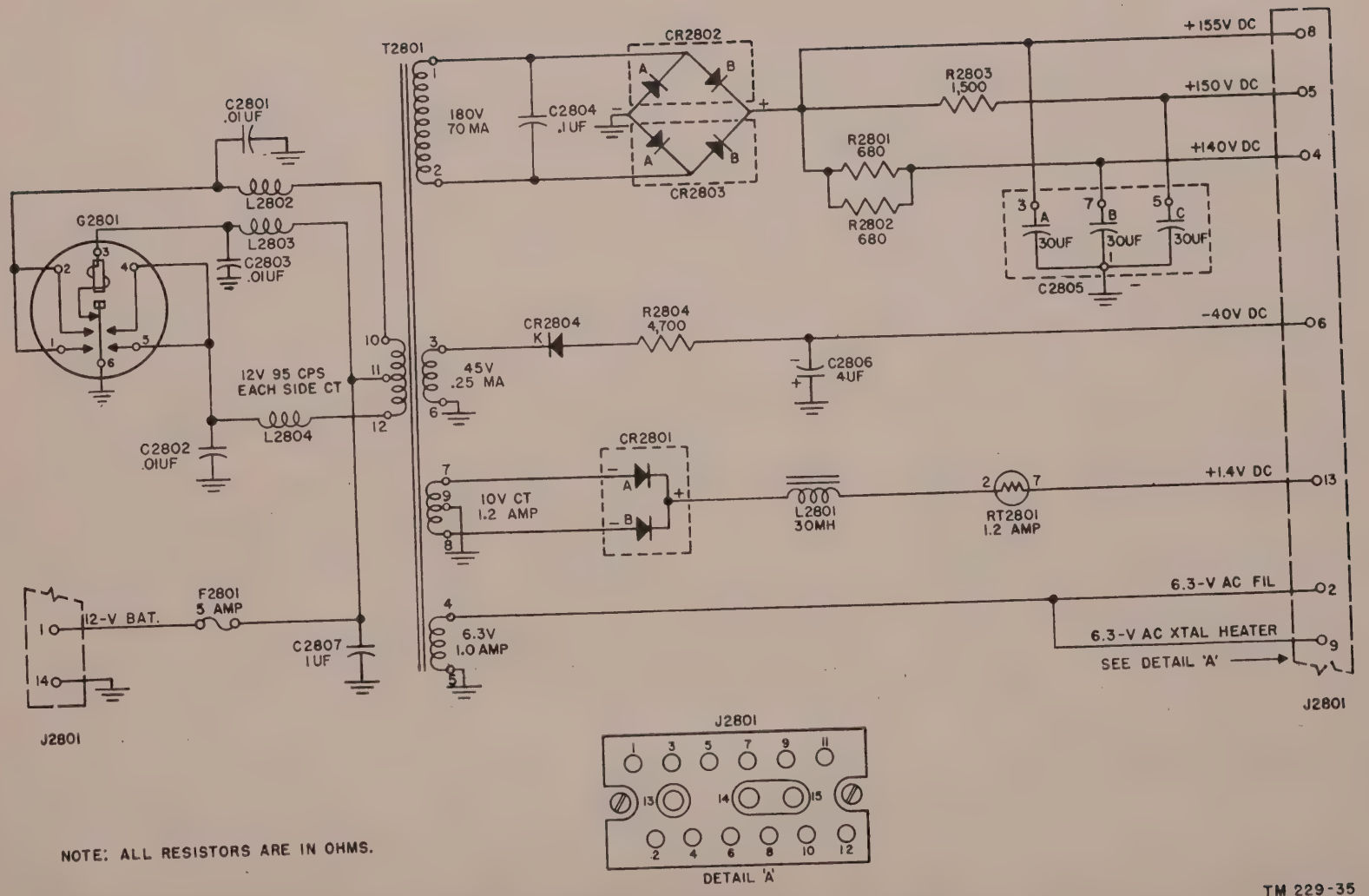
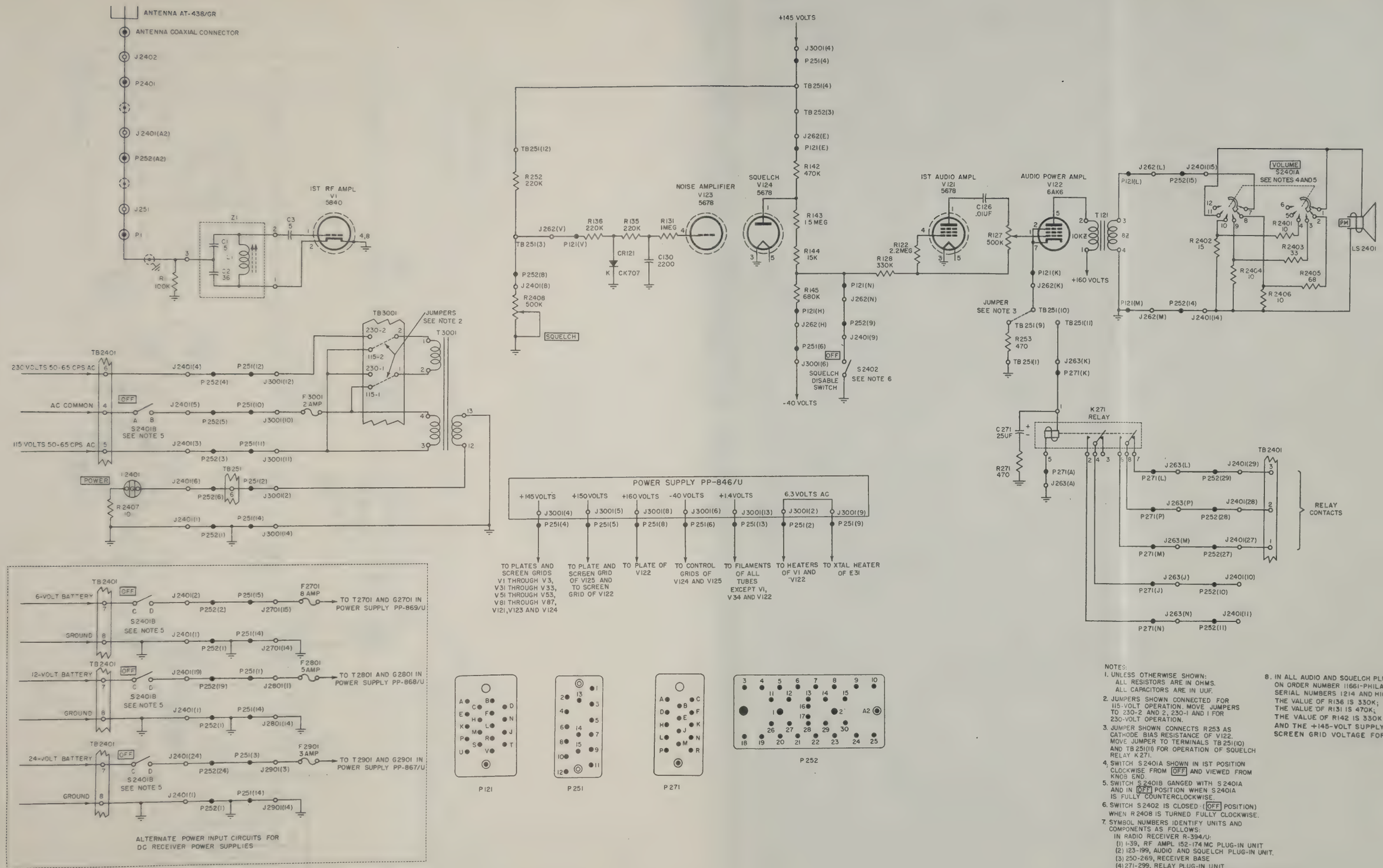


Figure 38. Power supply PP–868/U, schematic diagram.

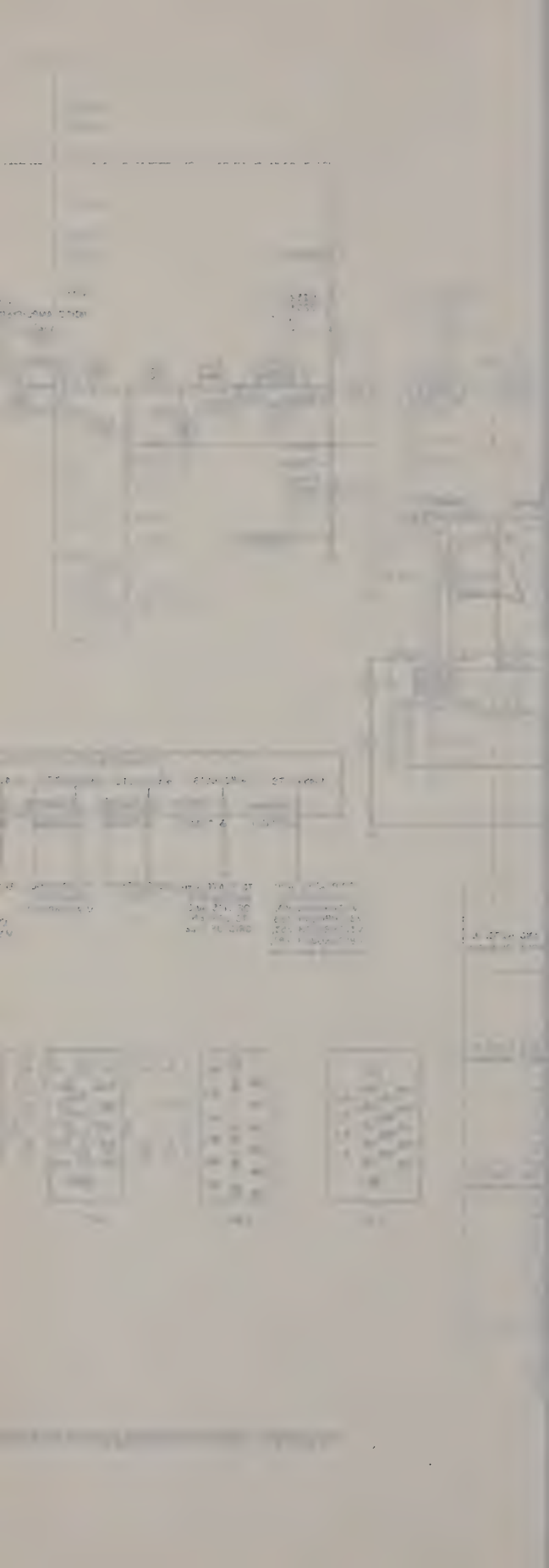


NOTES:

1. UNLESS OTHERWISE SHOWN:
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN UUF.
2. JUMPERS SHOWN CONNECTED FOR 115-VOLT OPERATION. MOVE JUMPERS TO 230-2 AND 2, 230-1 AND 1 FOR 230-VOLT OPERATION.
3. JUMPER SHOWN CONNECTS R253 AS CATHODE BIAS RESISTANCE OF V122. MOVE JUMPER TO TERMINALS TB 251(10) AND TB 251(11) FOR OPERATION OF SQUELCH RELAY K271.
4. SWITCH S2401A SHOWN IN IST POSITION CLOCKWISE FROM OFF AND VIEWED FROM KNOB END.
5. SWITCH S2401B GANGED WITH S2401A AND IN OFF POSITION WHEN S2401A IS FULLY COUNTERCLOCKWISE.
6. SWITCH S2402 IS CLOSED (OFF POSITION) WHEN R2408 IS TURNED FULLY CLOCKWISE.
7. SYMBOL NUMBERS IDENTIFY UNITS AND COMPONENTS AS FOLLOWS:
   IN RADIO RECEIVER R-394/U:
   (1) 1-39, RF AMPL 152-174 MC PLUG-IN UNIT
   (2) 123-199, AUDIO AND SQUELCH PLUG-IN UNIT.
   (3) 250-269, RECEIVER BASE
   (4) 271-299, RELAY PLUG-IN UNIT
   2401-2499, ELECTRICAL EQUIPMENT CABINET CY-1150/U.
   2701-2799, POWER SUPPLY PP-869/U
   2801-2899, POWER SUPPLY PP-868/U
   2901-2999, POWER SUPPLY PP-867/U
   3001-3099, POWER SUPPLY PP-846/U
8. IN ALL AUDIO AND SQUELCH PLUG-IN UNITS ON ORDER NUMBER 11661-PHILA-52 BEARING SERIAL NUMBERS 1214 AND HIGHER:
   THE VALUE OF R136 IS 330K;
   THE VALUE OF R131 IS 470K;
   THE VALUE OF R142 IS 330K;
   AND THE +145-VOLT SUPPLY FURNISHES SCREEN GRID VOLTAGE FOR V125.

TM 229-38

Figure 40. Radio receiving set AN/FRR-36, interconnecting and control circuits.



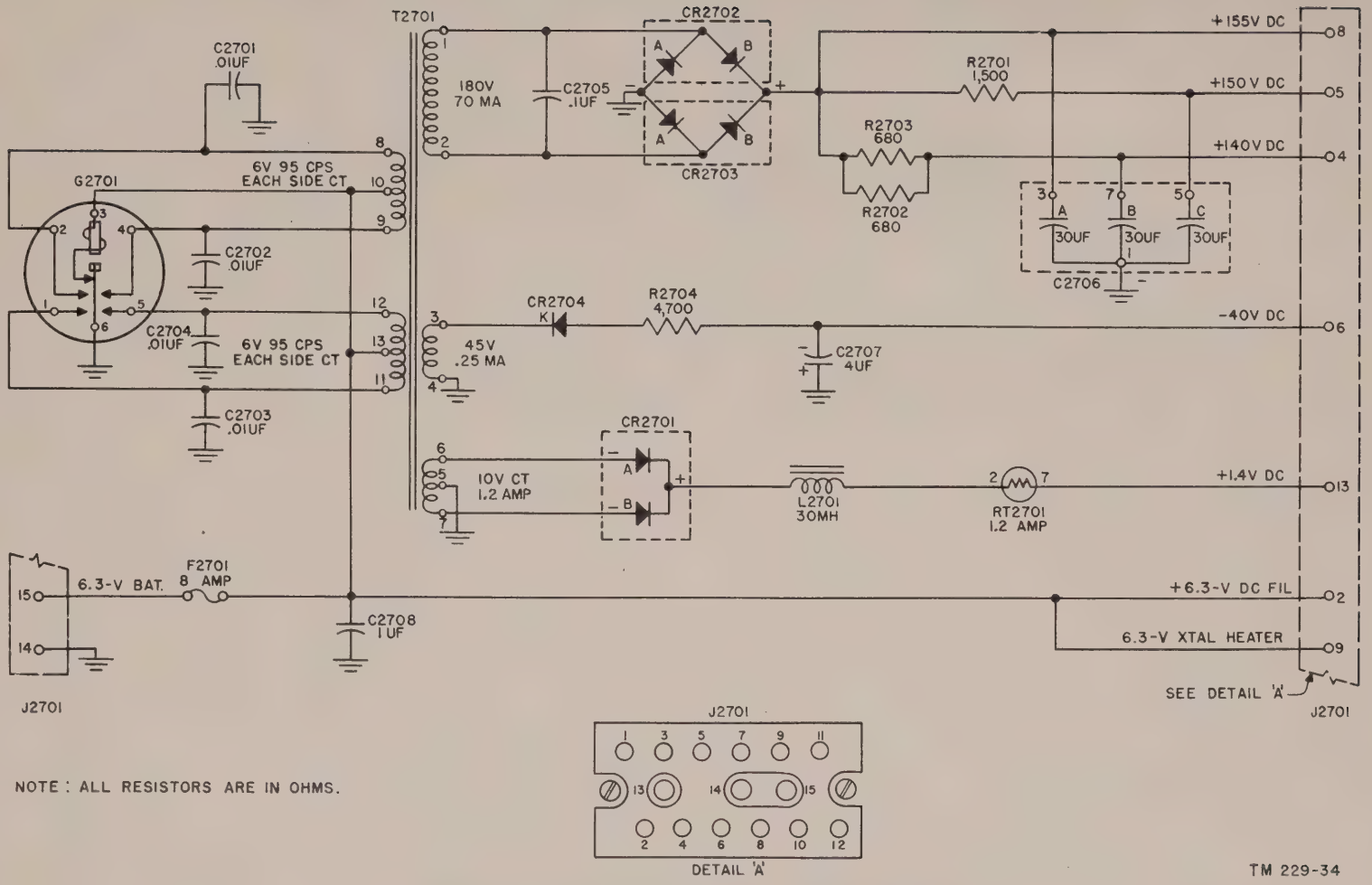


Figure 39. Power supply, PP 869/U, schematic diagram.

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11–128A, Sig Depot Co (2)
11–500A (AA–AE), Sig Admin Teams (2)
11–587A, Sig Base Maint Co (2)
11–592A, Hq & Hq Co, Sig Base Depot (2)
11–597A, Sig Base Depot Co (2)

NG: None.

USAR: None.

Unless otherwise noted, distribution applies to ConUS and overseas.
For explanation of abbreviations used, SR 320–50–1.

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